AN/ARQ-53
NAVY SHIPBOARD SINGLE CHANNEL GROUND AND AIRBORNE RADIO SYSTEM (SINCGARS)

TECHNICAL EVALUATION (DT-IIB) FINAL REPORT

SPACE AND NAVAL WARFARE SYSTEMS COMMAND
PMW 176

17 JUNE 96

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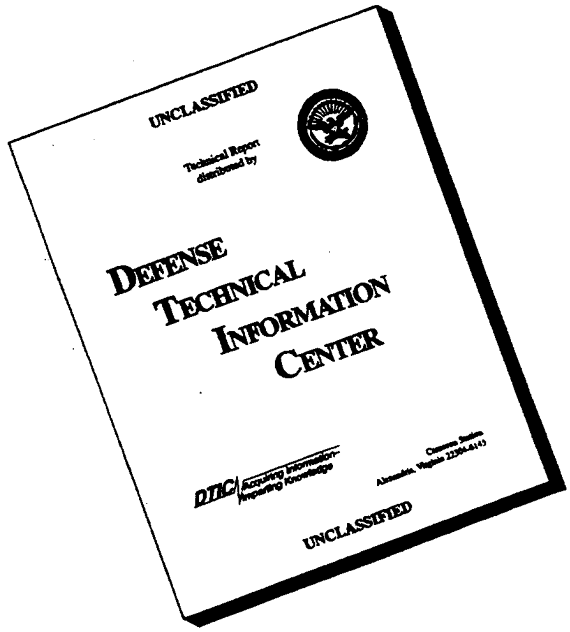

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AN/ARQ-53
NAVY SHIPBOARD SINGLE CHANNEL GROUND AND AIRBORNE RADIO SYSTEM (SINCGARS)

TECHNICAL EVALUATION (DT-IIB)

FINAL REPORT

Prepared by: Willy L. Leger 6/26/96
Willy Leger, PMW 176-3G Date

Reviewed by: T. McManus 6/25/96
Tim McManus, PMW 176-3B Date

Approved by: 6/26/96
CAPT K. D. Slaght, PMW 176 Date

statement A per
Willy Leger PMW 176-3G
9/30/96

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1.0 PURPOSE. The purpose of DT-IIB was to conduct both technical and operational testing in order to verify that the AN/ARQ-53 Navy Shipboard Single Channel Ground and Airborne Radio System (SINCGARS) is performing to the required equipment/system specifications and that it meets the critical technical and operational performance parameters and threshold requirements of the Test and Evaluation Master Plan (TEMP) No. 0706-02. Based on the results of testing, a decision will be made whether or not to certify the system ready to commence Operational Evaluation (OPEVAL) (OT-II).

2.0 EQUIPMENT/SYSTEM DESCRIPTION. The AN/ARQ-53 Navy Shipboard SINCGARS Airborne Relay provides tactical anti-jam (AJ), Very High Frequency - Frequency Modulated (VHF-FM) ship-to-ship and ship-to-air-to-shore/ship communications, used primarily for amphibious and surface fire support missions. All Navy SINCGARS Airborne Segment installations is comprised of Non-Developmental Item (NDI), Government Off-the-Shelf (GOTS), and Engineering and Manufacturing (E&MD) Developmental components housed in a removable equipment enclosure.

2.1 KEY FEATURES. The principle component of the AN/ARQ-53 is the RT-1476A AJ radio receiver-transmitter (RT), a GOTS component used in AN/ARC-201A SINCGARS for Army aircraft. The RT has a frequency range of 30.000-87.975 MHz and 2,320 channels with 25 kHz channel spacing in compliance with North Atlantic Treaty Organization Standardization Agreement (NATO STANAG) 4204. AJ is provided by a module embedded in the RT which produces the JTC3A 9001C prescribed SINCGARS electronic protection (EP) waveform, also known as frequency hopping (FH). In addition, Revised Battlefield Electronic Communications System (RBECS), an electronic counter-counter measure fill information and transmission security key, is used for the creation, generation, and distribution of joint communication electronic operating instruction on each platform. AN/ARQ-53 uses four RTs which are "paired". Each pair acts as an independent retransmission unit, providing two-way, point-to-point and netted VHF relay in both single channel (SC) and frequency hopping (FH) modes. AN/ARQ-53 included an Interference Cancellation Unit (ICU) to counter mutual interference caused by simultaneous operation of multiple RTs. The ICU, and other devices required for power distribution, etc., constitute the E&MD aspect of the Airborne Relay segment. For monitoring purposes, an H-250(A)/U Handset will be provided with each AN/ARQ-53.

2.2 TECHNICAL CHARACTERISTICS

2.2.1 TECHNICAL PARAMETERS

a. **Frequency Coverage** - 30.000 - 87.975 MHz

b. **Channels** - 2,320 discreet 25 kHz channel capacity, with 25 kHz channel spacing

c. **Bit Error Rate** - 10^2 (Frequency Hopping - (FH) Mode)
10^3 (Single Channel Non-FH Mode)

2.2.2 Survivability/Vulnerability. The requirements for the design and construction, environmental service conditions, parts selection, and testing of the AN/ARQ-53 are in accordance with the system specification, SPAWAR-S-839 of 25 March 1991.

2.2.3 Electromagnetic Pulse (EMP) Protection. All hardware components of the AN/ARQ-53 are designed to withstand an EMP resulting from an exoatmospheric nuclear explosion in accordance with MIL-STD-461 as addressed in the system specification.

2.2.4 Electromagnetic Compatibility (Platform/Force Level). All AN/ARQ-53 system hardware components met the applicable requirements of MIL-STD-461 as addressed in the system specification.

2.2.5 Interoperability. The AN/ARQ-53 system hardware is interoperable with Marine Corps and Army SINCGARS, and the AN/PSC-2A DCT, used with Marine Corps SINCGARS ashore for data exchange. It is also interoperable with allied VHF systems.

2.2.6 Compatibility (Physical and Environmental).

2.2.7 Safety. The AN/ARQ-53 system complies with the safety criteria of MIL-STD-2036 (formally MIL-E-16400), MIL-STD-1472, and Requirements 1, 8, 45, and 74 of MIL-STD-454.

2.2.8 **Human Factors**. The number, complexity, and frequency of tasks was evaluated to ensure optimum manpower requirements were realized. Human engineering criteria follows the guidelines of MIL-STD-1472 and MIL-H-46855.

2.2.9 **Reliability/Maintainability**. The AN/ARQ-53 system hardware was evaluated for compliance with the reliability and maintainability criteria specified in section 2.3.

2.3 OPERATIONAL CHARACTERISTICS

2.3.1 Operational Effectiveness Issues

Characteristics	Parameter	Threshold
Range (nmi = nautical miles)	Relay-to-Shore	$\geq$15 nmi
	Relay-to-Ship	$\geq$35 nmi

2.3.2 Operational Suitability Issues

Characteristic	Parameter	Threshold
Reliability	Mean Flight Hours Between Operational Mission Failures $(MFHBOMF)_{sys}$ (Note 1)	$\geq$90 hrs
Maintainability	Mean Corrective Maintenance Time for Operational Mission Failures (MCMTOMF) (Note 2)	$\leq$2 hrs
Availability	Operational Availability (A_o) (Note 3)	$\geq$0.90

Notes

(1) The reliability of Navy Shipboard SINCGARS Airborne Relay (AN/ARQ-53) will be expressed as $MFHBOMF_{sys}$. An operational mission failure is defined as any failure that prevents the system from performing its mission. $MFHBOMF_{sys}$ will be computed using the following formula:

$$MFHBOMF_{sys} = \frac{\text{Total Operating Time}}{\text{Total Number of Operational Mission Failures}}$$

(2) MCMTOMF is the total number of clock-hours of corrective, on-system, active repair time, which was used to restore failed systems to mission-capability status after an operational mission failure (OMF) occurs, divided by the total number of OMFs. MCMTOMF will be computed using the following formula:

$$MCMTOMF = \frac{\text{Total Corrective Maintenance Time}}{\text{Total Number of Operational Mission Failures}}$$

(3) Operational availability (A_o) is calculated as:

$$A_o = \frac{\text{Uptime}}{\text{Uptime + Downtime}}$$

2.3.3 Failure Definitions

a. Critical Failure. One that prevents the system from performing its mission or results in the loss of some significant mission capability.

b. Minor Failure. One that affects system performance but does not impact the ability to perform the mission.

3.0 BACKGROUND. SINCGARS was developed by the U. S. Army in response to a need identified in Joint Operational Requirement (JOR) JCSM 110-76. For AJ capability, JCSM 110-76 directed all military departments to adopt a common EP waveform in radios developed for this system. This EP waveform is further defined in JTC3A 9001C as the SINCGARS EP waveform.

Development of the Navy Shipboard SINCGARS was initiated under Operational Requirement (OR) 136-094-85, which was derived from JCSM 110-76. An updated Operational Requirements Document (ORD) 411-06-95, was approved 15 August 1995. The new ORD superseded OR 136-094-85, and identified specific criteria for the Navy Shipboard SINCGARS VHF AJ system. While Navy Shipboard

SINCGARS is being built around the basic Army-developed radio, additional distinct, yet related developments are necessary due to the uniqueness of the shipboard operating environment and specific Naval applications of this system. As stated in the ORD, among these developments is a SINCGARS relay to be carried by helicopter to support over-the-horizon (OTH) VHF communications, a shipboard interface unit to integrate available SINCGARS radios with shipboard communications systems, and a computer terminal to interface with the U.S. Marines AN/PSC-2A for digital data communications to support amphibious and Naval Surface Fire Support (NSFS) operations.

The AN/ARQ-53 developmental testing todate includes completion of Environmental Tests, EMI Tests, 6 flight tests at Pax River (15.0 hours), 7 flight tests at Eglin AFB (17.5 hours), 2 Optimization at Eglin AFB (2.0 hours) and 4 flight tests at Norfolk (10.0 hours) totaling 44.5 hours operational performance testing prior to and during DT-IIB. Appendices C, D, and E provide specific flight test results.

A Milestone Decision (MS-IIA) was conducted with a Program Decision Memorandum (PDM) being issued 28 February 1995. The PDM provided authorization that the Program Manager, upon successful completion of Operational Testing, proceed with Milestone III activities. A Milestone IIIA is being scheduled for 1st QTR FY97 to obtain a FRP authorization.

4.0 <u>SCOPE</u>

4.1 <u>OBJECTIVES</u>. The AN/ARQ-53, installed in a Helicopter (UH-1N of HMLA-167) interfaced with USS SAIPAN, USS GUNSTON HALL, and a representative ground unit, was tested in its operational environment. Representative communications circuits, ship-to-air-to-shore and shiip-to-shore were processed through the AN/ARQ-53 system to ensure the system is meeting program objectives.

The AN/ARQ-53 was exercised to verify that it is supporting the ship's operational requirements for information transfer. Logistic support identified in the Integrated Logistics Support Plan (ILSP) was evaluated. Operational testing evaluated the production representative AN/ARQ-53 system interfaced with equipment of its operating environment and involved complete end-to-end testing of telecommunications links. All aspects of operational effectiveness and operational suitability were evaluated. The testing provided a thorough examination of operational real-world communication links, system documentation, Planned Maintenance System (PMS), Allowance Parts Lists (APLs), drawings, spare parts, accuracy of records, equipment operation, and human and safety factors.

4.1.1 End-to-End System Assessment

To assess the adequacy of communications equipment, interfaces, and interactions between the AN/SRC-54 onboard the USS SAIPAN, and USS GUNSTON HALL, via the AN/ARQ-53 in the HMLA-167 UH-1N helicopter and a AN/VRC-90A equipped shore unit.

To verify the AN/ARQ-53 SINCGARS system/equipment performance using system specifications and DT-IIB Test Plan requirements.

4.1.2 Operational Effectiveness Issues

a. Operational Range. Will the AN/ARQ-53 provide effective voice and data communications, both secure and clear, at sufficient ranges to meet operational mission requirements?

b. Joint Interoperability. Will the AN/ARQ-53 effectively interface and operate with corresponding systems or units of other U.S. Forces in the execution of its intended operational mission?

c. Survivability. Will the susceptibility and vulnerability characteristics of the AN/ARQ-53 enhance the successful completion of the platform's mission?

4.1.3 Operational Suitability

a. Reliability. Will the reliability of the AN/ARQ-53 support completion of the host platform's mission?

b. Maintainability. Will the AN/ARQ-53 be maintainable by fleet personnel?

c. Availability. Will the availability of the AN/ARQ-53 support completion of the host platform's mission?

d. Logistic Supportability. Will the AN/ARQ-53 be logistically supportable?

e. Compatibility. Will the AN/ARQ-53 be compatible with its installed platform's operational environment?

f. Interoperability. Will the AN/ARQ-53 be interoperable with the systems in which it must interface?

g. **Training**. Will the AN/ARQ-53 training support operation and maintenance by fleet personnel?

h. **Human Factors**. Will the human factors aspect of the AN/ARQ-53 support completion of its mission?

i. **Safety**. Will the AN/ARQ-53 be safe to operate and maintain?

j. **Documentation**. Will the technical documentation support operation and maintenance of the AN/ARQ-53?

5.0 TEST CONDUCT AND RESULTS

The DT-IIB evaluation was conducted on a Not-to-Interfere Basic (NIB) onboard the USS SAIPAN, USS GUNSTON HALL, a HMLA-167 UH-1N TYCOM designated Amphibious Helicopter, and various other Aircraft and shore activities as provided in Appendices C, D, and E. The DT-IIB Test Plan (Appendix A) contains testing procedures, data sheets, and forms. These documents, along with communications logs, personnel interviews, Test Director observations, and operational performance of the system prior to and during DT-IIB, formed the basis of test conduct and results. The period of evaluation was 15 November 1994 to 31 May 1996, encompassing operations in various locations of the Atlantic Ocean and the Gulf of Mexico. The AN/ARQ-53 SINCGARS system functioned in its operational environment during DT-IIB.

5.1 EVALUATION CRITERIA. See paragraphs 2.2 and 2.3.

5.1.1 **Test Chronology**. Project evaluation commenced on 15 November 1994. Pre-deployment readiness checks, in addition to various system groom checks associated with the AN/ARQ-53 were performed. The results of these tests were reviewed by the Test Director and ISEA to determine deficiencies. The AN/ARQ-53 system/equipment demonstrated peak technical performance in accordance with equipment specifications (See SPAWAR-S-839 of 25 March 1991). DT-IIB Test Plan operational effectiveness and operational suitability data were collected and analyzed for airborne test periods from 15 November 1994 to 30 May 1996, that includes evaluation of the system's demonstrated operational performance provided in Appendices B through E. The ISEA and Test Team members provided additional/refresher training during the pre-deployment periods. The conduct and results of operational effectiveness tests (E-Tests) and operational suitability tests (S-Tests) are provided in the following paragraphs of this report.

5.1.2 General Approach. Testing exercised the AN/ARQ-53 system in its intended operational environment. The system was operated and maintained by test participants. The ISEA and Test Team personnel were instructed to provide assistance only in emergency situations.

5.1.3 End-to-End Assessment.

a. Adequacy. The adequacy of communications equipment, interfaces, and interactions between the AN/ARQ-53 in the designated aircraft and the communication unit ashore, were assessed to be satisfactorily supporting the platform's mission. The assessment results were obtained through end-to-end circuit testing providing communication circuits for ship-to-air-to-ship/shore during airborne operations.

b. Performance. The performance of the AN/ARQ-53 demonstrated the system/equipment specifications and Test and Evaluation Master Plan (TEMP) No. 0706-02 requirements as outlined in para 5.2 and 5.3. Performance tests were conducted during/in airborne operational environments, including induced tests during the period 15 November 1994 - 30 May 1996.

5.2 OPERATIONAL EFFECTIVENESS TESTS

5.2.1 Test E-1, Range

a. Objective. To verify that the system will provide effective communications at sufficient ranges to meet operational requirements.

b. Procedure. Test Team members obtained ship's position and distant-end communications circuit contact's position. Test Director observations were used to provide the basis for a determination of the range in distance and status of terminated circuits.

c. Data Analysis. Test Director observations/Notebook were quantitatively and qualitatively evaluated.

d. Results. The SINCGARS system demonstrated the capability to provide effective communications at sufficient ranges to meet mission operational requirements as stated in para. 2.3.1. The aircraft maintained various communications circuits during flight operations with a maximum range (w) relay of 42 nmi relay-to-shore and 75 nmi ship-to-shore via relay.

5.2.2 Test E-2, Survivability

a. Objective. To verify if the system operational performance or inherent characteristics do not increase the susceptibility or vulnerability of the platform in which it is installed.

b. Procedure. Test Director completed Data Sheet E-2 (Survivability Data Sheet). The Test Director also:

(1) Electromagnetic Pulse (EMP). Conducted a physical examination of the Helo's transmit antenna matching networks to ensure that they were in good working order.

(2) Vibration. Conducted a physical examination of the AN/ARQ-53 antennas.

(3) Power. Ensured radio circuits were maintained in the event of a partial AC power outage (as appropriate).

c. Data Analysis. Data Sheet E-2, personnel interviews, and Test Director physical examinations form the basis for a qualitative evaluation.

d. Results. No deficiencies were noted. The on-scene inspection of the AN/ARQ-53 system installation was completed using installation check lists. There were no adverse conditions that would affect survivability or make the system vulnerable to threats or damage. All cable runs were protected and shielded against EMP. All outside components were enclosed or protected from the elements. Flight Clearance Authorization was provided by COMNAVAIRSYSCOM. The system met Navy standards for survivability and vulnerability.

5.3 OPERATIONAL SUITABILITY TESTS

5.3.1 Test S-1, Reliability.

a. Objective. To verify the reliability of the system in its intended operational environment.

b. Procedure. This test was conducted continuously during all test operations by logging all failures. Data Sheet S-1 (Maintenance Action Form (MAF)) was provided for each operational failure and for those instances during preventive maintenance which revealed a failed component/part, element of hardware, or firmware. Test Director notebook, personnel interviews, historical records, logs, and maintenance documentation were reviewed. For this testing, failures were defined as:

(1) Critical Failure. Any failure which prevented the system from performing its mission.

(2) Minor Failure. Any failure that affects the system performance but does not impact the ability to perform the mission.

c. Data Analysis. Reliability was determined by computing MFHBOMF as follows:

$$MFHBOMF_{sys} = \frac{\text{Total Operating Time}}{\text{Total Number of Operational Mission Failures}}$$

d. Results.

(1) Total operating time was 44.5 hours.

(2) Total operational mission downtime was 0 hours (MFHBOMF criterion: $\geq$ 90 hours).

(3) There were 0 operational mission critical failures observed during 44.5 hours of operation. A Maintainability Demonstration was conducted.

5.3.2 Test S-2, Maintainability

a. Objective. To verify the maintainability of the system in its intended operational environment.

b. Procedure. This test was conducted continuously during all test operations by logging all failures. Data Sheet S-1 was completed for each operational failure and for those instances during preventive maintenance which revealed a failed component/part, element of hardware, or firmware. Test Director notebook, personnel interviews, historical records, logs, and maintenance documentation were reviewed.

c. Data Analysis. System maintainability was evaluated by computing the Mean Corrective Maintenance Time for Operational Mission Failures (MCMTOMF) from Data Sheet S-1 using:

$$MCMTOMF = \frac{\text{Corrective Maintenance Time}}{\text{Total Number of Operational Mission Failures}}$$

d. <u>Results</u>. During test operations, 0 operational mission failures occurred. MCMTOMF criterion: $\leq$ 2 hours. A maintainability demonstration was performed at NAWCAD Indianapolis IN with the following results:

FAULT NUMBER DESCRIPTIONS

FAULT NUMBER	DESCRIPTION OF FAULT
1	RFS power monitor (PM2) (J1 open)
2	Control panel power lamps
3	Control panel EMCON lamps
4	RFS power monitor (PM1) (J2 open)
5	RFS power failure
6	FMS power monitor (J1 open)
7	Control panel lamps for test indication failed
8	ICU power failure
9	Receiver/transmitter 2 intermittent display
10	Receiver/transmitter 2 RF cable failure
11	Receiver/transmitter 1 RF cable failure
12	Receiver/transmitter 3 RF cable failure
13	Receiver/transmitter 4 RF cable failure
14	Radio frequency amplifier 1 failed
15	Radio frequency amplifier 2 failed
16	Power distribution panel power failure
17	Power distribution panel FMS circuit breaker failure
18	Radio frequency switch power failure
19	Receiver Transmitter power failure
20	Headset failure (no audio)

RECORDED TIMES

FAULT NUMBER	ISOLATION TIME	REMOVAL TIME	REPLACEMENT TIME	Total Time
1	2:00	2:28	6:52	11:20
2	0:10	0:30	5:00	5:40
3	0:10	0:20	5:00	5:30
4	2:00	2:28	6:52	11:20
5	2:00	2:28	6:52	11:20
6	1:00	9:31	11:13	21:44
7	1:30	3:52	4:50	10:12
8	1:00	3:15	4:00	8:15
9	--	1:45	2:07	3:52
10	5:00	1:45	2:07	8:52
11	5:00	2:45	3:00	10:45
12	5:00	2:45	3:00	10:45
13	5:00	1:45	3:00	9:45
14	6:00	5:00	7:30	18:30
15	6:00	5:00	7:30	18:30
16	3:00	3:00	3:30	9:30
17	3:00	3:00	3:30	9:30
18	3:00	3:00	3:30	9:30
19	3:00	3:00	3:30	9:30
20	10:00	0:30	0:30	11:00

5.3.3 Test S-3, Availability

a. Objective. To verify the probability that the system will be operationally ready, when needed, at any point in time.

b. Procedure. This test was conducted continuously during test operations by logging all failures. Data Sheet S-1 was completed for each operational failure

b. Procedure. This test was conducted continuously during test operations by logging all failures. Data Sheet S-1 was completed for each operational failure and for those instances during preventive maintenance which revealed a failed component/part, element of hardware, or firmware. Test Director notebook, personnel interviews, historical records, logs, and maintenance documentation were reviewed.

c. Data Analysis. During test operations all pertinent operator logs and MAFs were reviewed. Availability was computed using the formula:

$$A_o = \frac{\text{Uptime}}{\text{Uptime} + \text{Downtime}}$$

(1) Uptime includes the time when the system is considered to be ready for use and is either operating, in standby, or off.

(2) Downtime is the time the system is inoperable because of repairs for mission critical failures and/or for restoration from mission critical faults, including off-board logistic delays. Downtime also includes planned maintenance time with a periodicity less than or equal to the test duration time that prevents the system from performing its assigned mission. Planned maintenance time is considered neutral time and is not included in the availability calculation.

d. Results. The demonstrated A_o was 100 (criterion: $\geq$ .90) based upon 44.5 hours of operation with 0 hours downtime.

5.3.4 Test S-4, Logistics Supportability

a. Objective. To assess AN/ARQ-53 logistic supportability in a deployed operational environment.

b. Procedure. This test was not conducted.

c. Results. This Priority Three NIB test was not conducted because of the limitation of assets during DT-IIB. The ships' and aircrafts' operational commitment prevented installation and deployment of the AN/ARQ-53 during DT-IIB.

TABLE 5-1 AN/ARQ-53 Documentation Checklist

TECHNICAL MANUALS		
EQUIPMENT	**Manual Number**	**Onboard**
AN/ARQ-53	EE-107-BD-OMD-010	YES
LOGISTICS DOCUMENTATION		
Integrated Logistic Support Plan	SPAWAR P4110.680B of 13 FEB 96	YES
User's Logistic Support Summary	SPAWAR P4110.945 of 13 FEB 96	YES
Navy Training Plan	NTP-E-70-9301 (Approved JUN 93) (Update NTP-E-70-9301A out for review and comment)	YES
Allowance Parts List	March 22, 1996	IN DEV

TABLE 5-2 AN/ARQ-53 MIP and MRC Checklist

	ONBOARD
MIP: Preliminary - AN/ARQ-53 RADIO REPEATER SET	YES
MRC: Preliminary - 180 Day Inspection (while in lay-up) (S-1)	YES
MRC: Preliminary - Pre-deployment inspection (R-1)	YES
MRC: Preliminary - Pre-mission Inspection (R-2)	YES
MRC: Preliminary - Post-deployment/long Term Storage Inspection (R-3)	YES

5.3.5 Test S-5, Compatibility

a. Objective. To assess the compatibility of the system with its operating environment.

b. Procedure. This test was conducted and evaluated continuously during the testing periods. The Test Director observed and noted any adverse effects from the operating environment, including:

(1) Temperature and humidity.

(2) Aircraft motion, shock, and vibration.

(3) Electrical and electronic interference, including voltage fluctuation, frequency instabilities, power failures, EMI, RF transmissions from own platform. Observations on system performance were recorded in the Test Director's Notebook.

c. Data Analysis. Compatibility data were analyzed qualitatively. The compatibility of the system with its operating environment was assessed. Temperature and humidity, platform motion, shock, vibration, electrical and electronic interference, including voltage fluctuation, frequency instabilities, power failures, EMI, RF transmissions from own platform were observed, recorded, and analyzed.

d. Results. No deficiencies were noted.

5.3.6 Test S-6, Interoperability

a. Objective. To verify the AN/ARQ-53 interoperability with other Department of Defense (DoD) and allied VHF equipment, as outlined in the Operational Requirements Document (ORD).

b. Procedure. This test was conducted continuously during project operations. Interoperability anomalies were noted in the Test Director's Notebook. The Communication Plan was examined to ensure the following types of circuits (System Tests) were demonstrated:

- Single Channel, Frequency Modulation (SC-FM) analog voice and data

- Frequency Hopping, Frequency Modulation (FH-FM) digital voice and data

- Single Channel analog data

- Single Channel digital data

- Frequency Hopping digital data

- SC-FM digital voice and data

c. Data Analysis. Interoperability data, including data rate testing using the AN/PSC-2 was qualitatively analyzed.

d. Results. All communications interoperability with the AN/PSC-2, AN/VRC-90A, and Shipboard SINCGARS AN/SRC-54 were evaluated satisfactorily.

5.3.7 Test S-7, Training

a. Objective. To verify the adequacy of the training planned for system operators and maintenance personnel.

b. Procedure. This test was conducted continuously during project operations. Personnel interviews were conducted by the Test Director and ISEA. The Test Director also concentrated on the following areas:

(1) System manning levels between the Navy Training Plan (NTP), ILSP, and ULSS.

(2) Training for General Purpose Electronic Test Equipment (GPETE).

(3) Training Facilities/Tools.

(4) Training adequacy.

c. Data Analysis. Training requirements data were qualitatively analyzed.

d. Results. Navy Training Plan provisions for manning requirements for technicians and operators were evaluated. The results identified the necessity to update the NTP to reflect Naval operational user requirements.

(1) 2 technicians received OJT.

(2) 0 operators received OJT.

5.3.8 Test S-8, Human Factors

a. Objective. To verify the adequacy of human factors features of the system.

b. Procedure. This test was conducted continuously during project operations. The Test Director conducted personnel interviews.

c. Data Analysis. Human factors data were qualitatively analyzed.

d. Results. No deficiencies were noted.

5.3.9 Test S-9, Safety

a. Objective. To verify the adequacy of system safety features and, where appropriate, observe the adequacy of Navy occupational health and safety standards of the system.

b. Procedure. This test was conducted continuously during project operations. Data concerning any safety deficiency identified was recorded in the Test Director notebook and on MAFs.

c. Data Analysis. Data was qualitatively analyzed.

d. Results. No deficiencies were noted. The equipment design and installation conformed to good safety practices. The AN/ARQ-53 system safety features were reviewed by the Test Director, and operation of the system was observed and found to meet Navy occupational health and safety standards. Hazard areas were well marked, the warning documentation included notations on hazards that could be encountered.

5.3.10 Test S-10, Documentation

a. Objective. To assess the adequacy and accuracy of the documentation provided for the system.

b. Procedure. This test was conducted continuously during project operations. The Test Director and ISEA also conducted personnel interviews and reviewed applicable documentation. Checklists provided in Tables 5-1 and 5-2 were completed.

c. Data Analysis. Documentation was qualitatively analyzed.

d. Results. Checklists provided in Tables 5-1 and 5-2 were completed. Documentation is in preliminary development.

6.0 CONCLUSION

a. The AN/ARQ-53 Single Channel Ground and Airborne Radio System demonstrated during DT-IIB, and other operational performance testing, that it meets or exceeds the technical requirements as outlined in TEMP 0706-02.

b. The AN/ARQ-53 Single Channel Ground and Airborne Radio System demonstrated during DT-IIB, and other operational performance testing, that it meets or exceeds the operational effectiveness and operational suitability requirements as outlined in TEMP 0706-02 with the exception of the following:

(1) Reliability - the MFHBOMF of $\geq$ 90 hours could not be demonstrated during testing due to limited available flight time allotted.

(2) Logistics Supportability - partially evaluated. Production sparing is in development.

(3) Training - Training provided to USMC technicians was limited due to operational commitment of HMM 266 personnel.

APPENDIX A

DT-IIB Technical Evaluation Test Plan

RcvD 6/10/96

AN/ARQ-53
NAVY SHIPBOARD SINGLE CHANNEL GROUND AND AIRBORNE RADIO SYSTEM (SINCGARS)

TECHNICAL EVALUATION (DT-IIB) TEST PLAN

SPACE AND NAVAL WARFARE SYSTEMS COMMAND
SPAWAR, PMW 176

April 1996

AN/ARQ-53
NAVY SHIPBOARD SINGLE CHANNEL GROUND AND AIRBORNE RADIO SYSTEM (SINCGARS)

TECHNICAL EVALUATION (DT-IIB) TEST PLAN

Prepared by: ____

Mr. Willy Leger PMW 176-3G   Date

Reviewed by: ____

Mr. Tim McManus PMW 176-3B   Date

Approved by: ____

CAPT Kenneth Slaght, PMW 176   Date

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DEVELOPMENTAL TESTING

1.0 INTRODUCTION

In accordance with the Test and Evaluation Master Plan (TEMP) No. 0706-02, AN/ARQ-53 Developmental Testing (DT-IIB) must be conducted. COMSPAWARSYSCOM shall certify the AN/ARQ-53 system ready for operational testing prior to commencement of the Operational Test and Evaluation (OPEVAL (OT-II)). During the technical evaluation TECHEVAL (DT-IIB), the AN/ARQ-53 System will be subjected to both technical and operational performance testing to ensure compliance with the system specifications and the Critical Operational Issues (COIs) of the TEMP. This TECHEVAL (DT-IIB) Test Plan outlines the critical technical and operational performance aspects of the testing and provides a description of the issues requiring verification.

2.0 OBJECTIVE

During the Navy SINCGARS TECHEVAL, the AN/ARQ-53 Airborne Relay system will be installed in a UH-1N Helicopter and tested in its operational environment. Representative communications circuits, ship-to-air-to-shore, shore-to-air-to-ship, and ship-to-air-to-ship, will be processed through the AN/ARQ-53 equipment to ensure the system is meeting the program objectives. The AN/ARQ-53 system will be exercised to ensure that it will support technical and operational requirements for information transfer. Logistic support identified in the Integrated Logistics Support Plan (ILSP) will be exercised. TECHEVAL will evaluate the production representative AN/ARQ-53 system that interfaces with its operating environment equipment. These interfaces will involve complete end-to-end testing of the very high frequency (VHF) telecommunications link. The operational effectiveness and suitability aspects AN/ARQ-53 system will be verified.

3.0 DOCUMENTATION SUPPORT

The status of documentation and technical manuals to support the AN/ARQ-53 system will be verified to ensure that current and up-to-date documentation is available. Table 3-1, AN/ARQ-53 Documentation Checklist, identifies the required technical documents to support the AN/ARQ-53 system. Table 3-2, AN/ARQ-53 MIP and MRC Checklist, identifies the Maintenance Index Pages (MIPs) and Maintenance Requirement Cards (MRCs) required to support the Planned Maintenance System (PMS). Table 3-3, AN/ARQ-53 GPETE Checklist, identifies the General Purpose Electronic Test Equipment (GPETE) required to maintain the AN/ARQ-53 system.

Table 3-1. AN/ARQ-53 Documentation Checklist

TECHNICAL MANUALS		
Equipment	**Manual Number**	**Onboard**
AN/ARQ-53	EE-107-BD-OMD-010	______
LOGISTICS DOCUMENTATION		
Integrated Logistic Support Plan	SPAWAR P4110-680B of FEB 96	______
User's Logistic Support Summary	SPAWAR P4110.945 FEB 96	______
Navy Training Plan	NTP-E-70-9301 (approved JUN 93) (update NTP-E-70-9301A out for review and comment)	______
Allowance Parts List	March 22, 1996	______

Table 3-2. AN/ARQ-53 MIP and MRC Checklist

		Onboard
MIP:	Preliminary	______
MRC:	Preliminary	______
MIP:	Preliminary	______
MRC:	Preliminary	______
MIP:	Preliminary	______
MRC:	Preliminary	______
MIP:	Preliminary	______
MRC:	Preliminary	______
MIP:	Preliminary	______
MRC:	Preliminary	______

Table 3-3. AN/ARQ-53 GPETE Checklist

SCAT Code	Description	Model Number	Onboard
4245	Multimeter; Digital 3½ Digit	77/BN	
4370	Generator, Signal, RF, AM/FM	6080A	
4958	Test Set, Power Measuring	4410-025	

4.0 CRITICAL TESTING ISSUES

Critical Testing Issues for verification during DT-IIB are:

a. Effectiveness Issues

(1) Range. Will the AN/ARQ-53 provide effective communications at sufficient ranges to meet operational requirements?

(2) Survivability. Will the operational performance or inherent characteristics of the AN/ARQ-53 system increase the susceptibility or vulnerability of the Helos in which they are installed?

(3) Electromagnetic Compatibility. Will the AN/ARQ-53 system be degraded due to platform or force level electromagnetic emission?

b. Suitability Issues

(1) Reliability. Will the reliability of the AN/ARQ-53 system support the completion of the Helo's mission?

(2) Maintainability. Will the AN/ARQ-53 system be maintainable by fleet personnel?

(3) Availability. Will the availability of the AN/ARQ-53 system support the completion of the Helo's mission?

(4) Logistic Supportability. Will the AN/ARQ-53 system be logistically supportable?

(5) Compatibility. Will the AN/ARQ-53 system be compatible with its operating environment?

(6) Interoperability. Will the AN/ARQ-53 system be interoperable with the systems with which it must interface?

(7) Training. Will the AN/ARQ-53 system training support the system operation and maintenance by fleet personnel?

(8) Human Factors. Will the human factors aspects of the AN/ARQ-53 system support completion of its mission?

(9) Safety. Will the AN/ARQ-53 system be safe to operate and maintain?

(10) Documentation. Will the AN/ARQ-53 system technical documentation support the operation and maintenance of the AN/ARQ-53 system?

5.0 TEST OBJECTIVES

The specific test objectives, critical testing issues to which they apply, and the tests designed to verify the issues are provided in Table 5-1. The organization which will be responsible for performing each test or providing data, as well as for analyzing/verifying the tests, are contained in Appendix C, AN/ARQ-53 DT-IIB Testing Schedule.

Table 5-1. Test Objectives, Critical Testing Issues, and Verification Tests

Specific Objectives	Critical Testing Issues	Verification Test
Verify the system's capability to provide communication at ranges that meet operational mission requirements	Range	E-1
Verify survivability	Survivability	E-2
Verify no degradation of the AN/ARQ-53 system due to platform or force level electromagnetic emissions	Electromagnetic Compatibility	E-3
Verify reliability, maintainability, and availability	Reliability Maintainability Availability	S-1 S-2 S-3
Verify logistic supportability and technical documentation	Logistic Supportability Documentation	S-4 S-10
Verify compatibility	Compatibility	S-5
Verify AN/ARQ-53 interoperability	Interoperability	S-6
Verify training, human factors, and safety	Training Human Factors Safety	S-7 S-8 S-9

6.0 EVALUATION CRITERIA

CNO provided the following evaluation criteria in TEMP No. 0706-02:

CHARACTERISTIC	PARAMETER	THRESHOLD
Operational Effectiveness:		
Range (nmi = nautical miles)	Ship-to-Relay Ship-to-Shore (w/relay)	$\geq$ 35 nmi $\geq$ 50 nmi
Operational Reliability:		
Reliability	Mean Flight Hours Between Operational Mission Failures ($MFHBOMF_{sys}$) (Note (1))	$\geq$ 90 hrs
Maintainability	Mean Corrective Maintenance Time for Operational Mission Failures (MCMTOMF) (Note (2))	$\leq$ 2 hrs
Availability	Operational Availability (A_0) (Note (3))	$\geq$ 0.90

Notes: (1) The reliability of Navy Shipboard SINCGARS (AN/ARQ-53) Airborne Relay will be expressed as "$MFHBOMF_{sys}$." An operational mission failure is defined as any failure that prevents the system from performing its mission. $MFHBOMF_{sys}$ will be computed using the following formula:

$$MFHBOMF_{sys} = \frac{\text{Total Operating Time}}{\text{Total Number of Operational Mission Failures}}$$

(2) MCMTOMF is the total number of clock hours of corrective, on-system, active repair time, which is used to restore failed systems to mission-capable status after an Operational Mission Failure (OMF) occurs, divided by the total number of OMFs. MCMTOMF will be computed using the following formula:

$$MCMTOMF = \frac{\text{Total Corrective Maintenance Time}}{\text{Total Number of Operational Mission Failures}}$$

(3) Operational availability (A_O) is calculated as:

$$A_O = \frac{\text{Uptime}}{\text{Uptime + Downtime}}$$

Where "uptime" is time when the system is considered to be ready for use and is either operating, in standby, or off. "Downtime" is the time the system is down for repair of operational mission failures, including off-board logistic delays. It also includes planned maintenance time of a periodicity less than or equal to the test duration time that prevents the system from performing its assigned mission. Planned maintenance time that is of periodicity greater than the test duration time is considered neutral time and is not included in the availability calculation.

7.0 TESTS

The AN/ARQ-53 system will be exercised in its intended operational environment. The test below will provide the test data for evaluation of effectiveness (E-tests) and suitability (S-tests) issues discussed in paragraphs 7.2 and 7.3.

a. Safety. In the conduct of all operations associated with this project, SAFETY IS PARAMOUNT. No operations will be conducted that, in the opinion of the Commanding Officer, the Test Director or his designated representative will endanger personnel or equipment. If an unsafe situation should develop, report immediately to the Test Director, his designated representative or the Commanding Officer. Also, notify the Commander, Space and Warfare System Command (COMSPAWARSYSCOM), or the Naval Air Warfare Center (NAWC) Indianapolis In-Service Engineering Activity (ISEA) of the circumstances as soon as possible. Include any rectifying safety procedures and any further action required or recommended.

b. Data Collection

(1) Data Sheets. Special data sheets for use during this test period are contained in Appendix B. Blank copies of the data sheets and forms will be distributed to test participants by the Test Director. Standard Navy forms, logs, 8 o'clock reports, etc., are identified and described in paragraphs 7.2 and 7.3.

(2) Data Recording. Operators' verbal comments, completed data sheets, and personnel interviews conducted by the Test Director will complete the data collection process.

7.1 Prerequisite Tests

During TECHEVAL, all Planned Maintenance System (PMS) tests associated with the AN/ARQ-53 system shall be performed. The results of these tests will be reviewed by the ISEA to determine any deficiencies. All deficiencies not corrected by ship's force will be corrected by the ISEA during the DT period.

7.2 Effectiveness Tests (E-Tests)

Effectiveness testing will exercise the AN/ARQ-53 system in its intended operational environment. The system shall be operated during this test by air crew personnel.

- A description of each test including test objective, procedures, data requirements, and data analysis is included in this section. Test procedures and data collection for one test may meet the requirements of several tests simultaneously.

- Interviews with supervisors, operators, and maintainers will be conducted by the Test Director throughout the evaluation period.

- The system will be used to process real-world first-run message traffic throughout the evaluation period.

- Copies of test reports, Technical Control Logs and Supervisor Logs will be appropriately classified and retained by test participants. The Test Director will obtain copies of these logs for analysis following the testing period.

7.2.1 Test E-1: Range

a. Objective. To verify if the system will provide effective communications at sufficient ranges to meet operational requirements.

b. Procedure. The test team shall provide Data Sheet E-1 (Communication (Circuit) Capacity Summary). These reports, supervisor/technical control logs, and 8 o'clock reports will be provided to the Test Director. Using this information, the Test Director will make a determination as to whether or not the range was adequately tested.

c. Data Requirements. Using status reports, logs, etc. the test team shall complete for each day of the test period, Data Sheet E-1 (Communication (Circuit) Capacity Summary). Data Sheet E-1 will be used to summarize the maximum distance of radio circuits.

d. Data Analysis. Data Sheet E-1 will be quantitatively/qualitatively evaluated.

7.2.2 Test E-2: Survivability

a. Objective. To verify that the system operational performance or inherent characteristics do not increase the susceptibility or vulnerability of the platform in which it is installed.

b. Procedure

(1) Electromagnetic Pulse (EMP). Conduct a physical examination of the Helo's transmit antenna matching networks to ensure that they are in good working order.

(2) Vibration. Conduct a physical examination of AN/ARQ-53 antennas.

(3) Power. Ensure radio circuits can be maintained in the event of a partial AC power outage (as appropriate).

c. Data Requirements. Data Sheet E-2 will be completed to determine the survivability of the system.

d. Data Analysis. Data Sheet E-2 and communications logs will be quantitatively/ qualitatively evaluated.

7.2.3 Test E-3: Electromagnetic Compatibility

a. Objective. To verify if the system operational requirements will be degraded due to platform or force level electromagnetic emission.

b. Procedure

- Ship's force shall complete Data Sheets E-1 (Communication Circuit Log) and E-3 (Electromagnetic Compatibility). Using these logs and supervisory/user comments, the Test Director will make a determination if electromagnetic interference prevented or disrupted radio communications. Interference is defined as "loss of information."

- The Test Team will conduct an examination of ships records to determine if the Electromagnetic Interference (EMI) survey is current and indicates any previous problems.

c. Data Requirements. Data Sheet E-1 and E-3 will be completed to determine if any electromagnetic interference observed affected system communications.

d. Data Analysis. Data Sheet E-1, E-3, and communication logs will be quantitatively/ qualitatively evaluated.

7.3 Suitability Tests (S-Tests)

The suitability testing will, in most instances, use data generated by continuous operations of the system throughout test operation, including the E-test runs described in paragraph 7.2. Tests specifically designed to generate suitability data are described below following the tests to which they apply.

7.3.1 Test S-1: Reliability

a. Objective. To verify the reliability of the system in its intended operational environment.

b. Procedure. This test will be conducted continuously during test operations by logging all failures. Data Sheet S-1 (Maintenance Action Form (MAF)) will be completed for each operational failure and for those instances during planned maintenance which reveal a failed component/part or element of hardware or firmware.

c. Data Requirements. Data Sheet S-1 will be completed for:

- Each failure or discrepancy noted during operations.

- Each corrective maintenance action.

d. Data Analysis. The reliability of Navy Shipboard SINCGARS (AN/ARQ-53) Airborne Radio will be expressed as "$MFHBOMF_{sys}$." A operational mission failure is defined as any failure that prevents the AN/ARQ-53 from performing its mission. The formula for computing $MFHBOMF_{sys}$ is:

$$MFHBOMF_{sys} = \frac{\text{Total Operating Time}}{\text{Number of Operational Mission Failures}}$$

7.3.2 Test S-2: Maintainability

a. Objective. To verify the maintainability of the system in its intended operational environment.

b. Procedure. This test will be conducted continuously during test operations by logging all failures. Data Sheet S-1 (MAF) will be completed for each operational failure and for those instances during preventive maintenance which reveal a failed component/part or element of hardware or firmware. If insufficient system failures occur during testing (hardware, firmware, or component failures), records, logs and maintenance forms will be reviewed to obtain additional data.

c. Data Requirements. During test operations, all pertinent operator logs, MAFs (Data Sheet S-1), and activity records will be reviewed.

d. Data Analysis. The maintainability of the SINCGARS AN/ARQ-53 will be expressed as "MCMTOMF." MCMTOMF is the average elapsed corrective maintenance time needed to repair all mission critical failures/faults, including time for maintenance preparation, fault location and isolation, on-board parts procurement, fault correction, and adjustment and calibration, as well as follow-up checkout time. MCMTOMF does not include off-board logistics delay time. The following formula will be used to determine MCMTOMF:

$$MCMTOMF = \frac{\text{Corrective Maintenance Time}}{\text{Total Number of Operational Mission Failures}}$$

7.3.3 Test S-3: Availability

a. Objective. To verify the probability that the system will be operationally ready, when needed, at any point in time.

b. Procedure. This test will be conducted continuously during test operations by logging all failures. Data Sheet S-1 will be completed for each operational failure and for those instances during preventive maintenance which reveal a failed component/part or element of hardware or firmware.

c. Data Requirements. During test operations, all pertinent operator logs, MAFs (Data Sheet S-1), and activity records will be reviewed.

d. Data Analysis. Availability (A_0) will be computed using the formula:

$$A_0 = \frac{\text{Uptime (in hours)}}{\text{Uptime + Downtime (in hours)}}$$

Where "uptime" is time when the system is considered to be ready for use and is either operating, in standby, or off. "Downtime" is the time the system is down for repair of operational mission failure, including off board logistic delays. It also includes planned maintenance time of a periodicity less than or equal to the test duration time that prevents the system from performing its assigned mission. Planned maintenance time that is of periodicity greater than the test duration time is considered neutral time and is not included in the availability calculation.

7.3.4 Test S-4: Logistic Supportability

a. Objective. To verify the logistic supportability of the system in an operational environment.

b. Procedure. This test will be conducted continuously during the testing period:

(1) The adequacy of the Integrated Logistic Support Plan (ILSP) SPAWAR 4110-680B of February 1996 (update to NTP-E-70-9301, approved June, 1993) will be evaluated.

(2) The following items related to logistic support will be evaluated:

(a) Clarity, completeness, accuracy, and availability of technical manuals and planned Maintenance System (PMS) documentation

(b) Availability and adequacy of test equipment and special tools as provided in the ILSP

(c) Adequacy of support (including spare parts, operating and maintenance procedures, and training) provided in conjunction with test equipment and special tools

(d) Adequacy of supply support

1 The requirements for, and availability of, spare parts will be evaluated. Any requirements that indicate unexpectedly high component failure rates will be investigated.

2 Logistics delays in obtaining replacement components will be investigated.

(e) The adequacy of the following aspects of support will also be evaluated:

1 Calibration requirements for all GPETE.

2 All support resources used during testing that are not to be available to operational units will be noted.

c. Data Requirements

(1) The data required to conduct this test are as follows:

(a) Integrated Logistic Support Plan (ILSP)

(b) All technical manuals and PMS documentation

(c) Completion of checklist contained in Tables 3-1, 3-2, and 3-3

(d) Data Sheet S-3 will be completed by system maintainers. The Test Director will also conduct personnel interviews.

d. Data Analysis. Logistic support data will be qualitatively evaluated.

7.3.5 Test S-5: Compatibility

a. Objective. To verify the compatibility of the system with its operating environment.

b. Procedure. This test will be conducted continuously during the testing period. Special consideration will be given to impact of AN/ARQ-53 electromagnetic interference on/from other installed RF generating systems.

c. Data Requirements. Observations on the system's performance will be recorded by operator/maintenance personnel in the operator's/maintenance logs, Data Sheet E-3, and Data Sheet S-2.

d. Data Analysis. Compatibility data will be qualitatively evaluated.

7.3.6 Test S-6: Interoperability

a. Objective. To verify the AN/ARQ-53 interoperability with other Department of Defense (DOD) and allied (VHF) equipment, as outlined in the Operational Requirements Document (ORD).

b. Procedure. The Helo's COMM Plan will be examined to ensure the system is being used to the full extent possible. This test will be conducted continuously during the testing period.

c. Data Requirements. Data requirements contained in the system tests listed above, as well as from interoperability anomalies noted by supervisory personnel in the supervisor's log, Data Sheets E-1, and Data Sheet S-2.

d. Data Analysis. Interoperability data will be qualitatively evaluated.

7.3.7 Test S-7: Training

a. Objective. To verify the adequacy of training for system operators and maintenance personnel.

b. Procedure. This test will be conducted continuously during the testing period.

c. Data Requirements. Personnel interviews will be conducted by the Test Director, and Data Sheet S-2 will be completed by supervisors and system operators/maintainers.

d. Data Analysis. Training requirements data will be qualitatively analyzed.

7.3.8 Test S-8: Human Factors

a. Objective. To verify the adequacy of human factors features of the system.

b. Procedures. This test will be conducted continuously during the testing period.

c. Data Requirements. Data Sheet S-2 will be completed by system supervisors/ operators/maintainers. The Test Director will also conduct personnel interviews.

d. Data Analysis. Human factors data will be qualitatively evaluated.

7.3.9 Test S-9: Safety

a. Objective. To verify the adequacy of system safety features and, where appropriate, observe the adequacy of Navy occupational health and safety standards of the system.

b. Procedures. This test will be conducted continuously during the testing period.

c. Data Requirements. Data Sheet S-2 will be completed by system supervisors/operators/maintainers. Data concerning any identified safety deficiency will be recorded in the supervisor's log, the Test Director's notebook, and on the MAFs.

d. Data Analysis. Data will be qualitatively evaluated.

7.3.10 Test S-10: Documentation

a. Objective. To verify the adequacy and accuracy of the documentation provided for the system.

b. Procedure. This test will be conducted continuously during the testing period.

c. Data Requirements. Checklists provided in Tables 3-1, 3-2, and 3-3 will be completed.

d. Data Analysis. Documentation data will be qualitatively evaluated.

7.4 Test and Test Data Sheet Reference

A quick reference matrix is provided in Table 7-1 for test and test data sheet reference.

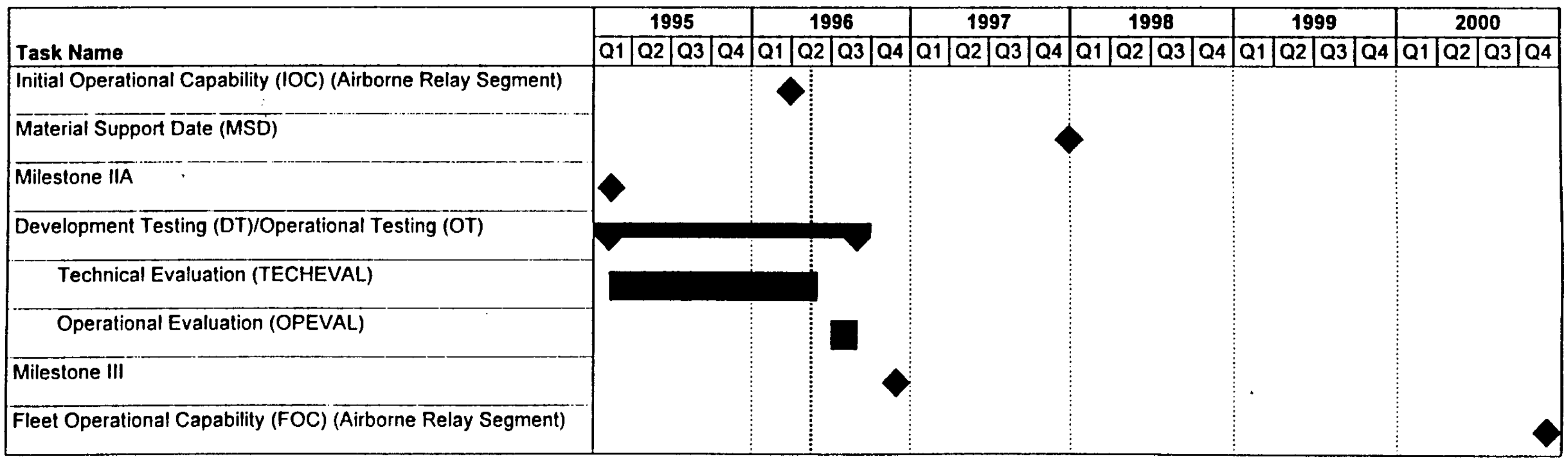
Table 7-1. AN/ARQ-53 TECHEVAL Test and Test Data Sheet Matrix

Test	Test Description	Data Sheets	Page No.
E-1	Range	Data Sheet E-1	B-2, B-3
E-2	Survivability	Data Sheet E-2	B-4, B-5
E-3	Electromagnetic Compatibility	Data Sheet E-3	B-6, B-7
S-1	Reliability	Data Sheet S-1	B-8, B-9
S-2	Maintainability	Data Sheet S-2	B-10 - B-17
S-3	Availability	Data Sheet S-3	B-18
S-4	Logistics Supportability	Tables 3-1, 3-2, and 3-3 Data Sheet S-3	2 and 3, B-18
S-5	Compatibility	Data Sheet E-3 Data Sheet S-2 Supervisor's Log	B-6, B-7 B-11
S-6	Interoperability	Supervisor's Log, Data Sheet E-1 Data Sheet S-1 Data Sheet S-2	 B-4 B-9 B-14
S-7	Training	Data Sheet S-2	B-16, B-17
S-8	Human Factors	Data Sheet S-2	B-10 - B-17
S-9	Safety	Data Sheet S-2	B-14 - B-16
S-10	Documentation	Table 3-1, 3-2, and 3-3	2 and 3

8.0 SCHEDULE

An overall schedule/milestones for the AN/ARQ-53 SINCGARS TECHEVAL and OPEVAL (DT-IIB/OT-II) is provided in Table 8-1, DT/OT Schedule of Events. The DT-IIB testing schedule of individual tests to be conducted and the organization who will be responsible for each test are contained in Appendix C, AN/ARQ-53 DT-IIB Testing Schedule.

Table 8-1. DT/OT Schedule of Events



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APPENDIX A

POINTS OF CONTACT

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Table A-1. Points of Contact

Name	Organization	Telephone	Area of Responsibility
CAPT K. Slaght	SPAWAR PMW 176	(703) 602-8331	Program Manager
Bob Benson	SPAWAR PMW 176-3	(703) 602-8368	Division Head
Tim McManus	SPAWAR PMW 176-3B	(703) 602-8336	Branch Head
Willy Leger	SPAWAR PMW 176-3G	(703) 602-8334	Project Engineer
Angela Anderson	SPAWAR PD70L21B	(703) 602-4901	ILS
Vince Kopek	NISE East Charleston	(804) 485-6422	DT-IIB Test Director
Keith Williams	NAWC-AD Indianapolis	(317) 306-2900	ISEA, Team Leader
Bruce Evenson	NAWC-AD Indianapolis	(317) 306-2900	ILS

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APPENDIX B

FORMS AND DATA SHEETS

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FORMS AND DATA SHEETS

1. Introduction. Appendix B is promulgated to enable program data collection. Guidance contained in the basic test plan is expanded herein to aid designated data collection.

2. General.

   a. Greenwich Mean Time (GMT) ZULU shall be used when it is required for data recording. When data sheets are passed down between watch cycles, the responsibility for delivering each completed data sheet lies with the individual completing the final entry. Even incomplete data sheets are of value for system evaluation. Include any incomplete or partially filled data sheets in the data sheets package.

   b. Logs and records shall be appropriately classified and duplicated. Deliver the duplicated copies to the Test Director. Logs and records or excerpts of logs and records obtained during the test cycle are official documents.

3. Special Instructions. (for Data Sheet E-1, page 2 of 2)

   a. Columns 1 through 4 will be used in the same manner as standard traffic circuit logs except that Column 1 will be left blank on sheets used to document transmission/ receipt of record traffic on voice circuits.

   b. Column 5 will be used to enter the number of transmissions required to accomplish delivery/receipt of each message. Example: If more than a single transmission is required to send/receive a message, enter "2" in Column 5. Enter "3" in Column 5 if three transmissions are required to send/receive a message. <u>A MAXIMUM OF THREE TRANSMISSIONS SHOULD BE ATTEMPTED TO ACCOMPLISH DELIVERY / RECEIPT OF AN INDIVIDUAL MESSAGE</u>. If unsuccessful after three transmissions, the circuit should be logged out and referred to tech control. When the circuit is restored to service, the reason for outage supplied by tech control will be listed in Column 6 for the appropriate message.

   c. Enter in Column 6 reasons for any retransmissions. Reasons for retransmissions should be as concise as possible. Reasons for garbled messages should be determined if possible. The entry "garbled" in Column 6 will suffice if a message garbled for no apparent or identified cause. As indicated above, coordination with circuit control will be required, in some cases, to determine the reason for retransmission. When distant end operators request retransmissions, query them for reasons after the message is receipted.

Test Plan
Data Sheet E-1
Page 1 of 2
Date ________

COMMUNICATION (CIRCUIT) CAPACITY SUMMARY DATA SHEET
(To be completed by Circuit Operators)

NAME ______________________ RANK/RATE __________ DATE __________

RADAY _____ AT-SEA _____ INPORT _____

(1)	(2)	(3)	(4)		(5)		(6)
					EST. RANGE (NM)		
CKT TYPE	TERMINATION	HOURS IN USE	SEND	RCV			REMARKS

CKT TYPE: VOICE	DATA	TELETYPE
SC FM analog SC FM digital FH FM digital	SC FM analog SC FM digital FH FM digital	SC FSK analog SC FSK digital FH FSK digital

COMMUNICATION (CIRCUIT) CAPACITY SUMMARY DATA SHEET (Cont'd)

WATCH SECTION: ______________________ PAGE _____ OF _____

RADAY _____ AT-SEA _____ INPORT _____ CIRCUIT _____ SEND _____ RECV _____

(1)	(2)	(3)	(4)	(5)	(6)
MSG NO.	DTG	TOR/TOD	CHOP	XMSNS REQD	REASON FOR RETRANSMISSION

ADDITIONAL REMARKS (KEYED TO CHANNEL NO. IF APPROPRIATE)

____

____

____

____

____
Signature

Date: ________

SURVIVABILITY DATA SHEET

EMP:

Does the antenna appear to have any physical damage? Yes _____ No _____

If Yes, describe ____

____

____

____

____

____

____

____

VIBRATION: Are antennas securely fastened (i.e., not just hand tight)?

Antenna ___ (Location ______) Yes _____ No _____
Antenna ___ (Location ______) Yes _____ No _____
Antenna ___ (Location ______) Yes _____ No _____
Antenna ___ (Location ______) Yes _____ No _____

____
Signature

SURVIVABILITY DATA SHEET (Cont'd)

POWER: Is AN/ARQ-53 provided AC power from two independent banks/sources? (applies to CH-46/53) (read 28VDC for UH-1) Yes _____ No _____

In the event of partial loss of AC power, are there any critical components that would be inoperable? Yes _____ No _____

If Yes, describe ____

____

____

____

____

____

____

Can AN/ARQ-53 be provided power from platform's emergency power ? Yes _____ No _____

Have you ever experienced any problems (i.e., unbalanced phases, low voltage conditions, etc.) with either power source? Yes _____ No _____

If Yes, describe ____

____

____

____

____

____

____

____
Signature

Date: ________

ELECTROMAGNETIC COMPATIBILITY DATA SHEET
(To be completed by Circuit Operators)

EMI SURVEY: Date of last EMI survey. Date:______________________

If Yes, describe ____

____

____

____

____

____

____

____

____
Signature

ELECTROMAGNETIC COMPATIBILITY DATA SHEET (Cont'd)

EMI SOURCES: Did you detect any electromagnetic interference that disrupted radio communications, resulting in lost information? Yes _____ No _____

If Yes, describe ____

____

____

____

____

____

____

____

What do you believe was the source of the interference?

Possible sources of EMI:

HF Transmitters	_____
UHF Transmitters	_____
Radars	_____
Deck Machinery	_____
AC Power	_____
Flight Deck	_____
Other (____________________)	_____

____
Signature

Date: ________

MAINTENANCE ACTION FORM (MAF)
(To be completed by Maintenance Technicians)

1. Job Control Number Information:

   ________ Unit Identification Code

   ________ Work Center

   ________ Job Sequence Number

2. Fill in the date/time (ZULU) that each of the following events/actions occurred, as applicable:

   ________ Z Equipment down/failed

   ________ Z Trouble isolation commenced

   ________ Z Trouble isolation completed

   ________ Z Part(s) ordered ____________________

   ________ Z Part(s) received

   ________ Z Part(s) installation commenced

   ________ Z Part(s) installation completed

   ________ Z Equipment up/returned to normal operation

3. Equipment Identification ____________________

   Part Ordered ____________________

   ____

   ____

   ____

4. Source of replacement part(s): (check one)

   ________ Shop Spares

   ________ Navy Supply Center

   ________ Other .... (Explain) ________________________________

MAINTENANCE ACTION FORM (MAF) (Cont'd)

5. Maintenance technician's analysis of the cause of the failure:

____

____

____

6. Additional comments pertinent to this maintenance action:

____

____

____

7. Name, rank/rate of technician performing this maintenance action:

____

____

____

____
Signature

HUMAN FACTORS QUESTIONNAIRE

(To be completed by Supervisors, Operators and Maintenance Personnel)

NAME ______________________ RANK/RATE __________ DATE __________

PNEC ______________ SNEC ______________ YEARS IN SERVICE ____________

MONTHS OF EXPERIENCE ON THE SPECIFIC EQUIPMENT ________________

SUPERVISOR ______________________

Purpose and Instructions: The purpose of this questionnaire is to assist in evaluating the specified equipment from a human factors aspect. Your opinion concerning the adequacy of the system's design, operation, maintainability, safety, number of required personnel, their ratings, NECs, and experience will assist in this evaluation and help ensure a better product for the fleet. If a question is not applicable to your man/machine relationship, mark "N/A" by the question. Use the reverse of this questionnaire or additional sheets, as necessary, to provide short but complete answers.

1. List schools/training which you have attended that are directly related to the specified equipment.

SCHOOLS/TRAINING	LENGTH	START DATE

2. List other related schools/training you have attended.

SCHOOLS/TRAINING	LENGTH	START DATE

HUMAN FACTORS QUESTIONNAIRE (Cont'd)

CONTROLS

0001 How would you assess the ability of a trained operator to manipulate the equipment of the system as designed?

OUTSTANDING ___ EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT ___

COMMENTS: ____

____

0002 Are all of the critical controls easy to reach?

NO ___ YES ___ if NO, name and describe ____

____

0003 What is your assessment of the location of guarded and/or critical controls, preventing them from being moved accidentally?

OUTSTANDING ___ EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT ___

COMMENTS: ____

____

0004 Do your fingers ever slip off any of the pushbuttons?

NO ___ YES ___ if YES, name and describe ____

____

0005 How would you assess the ease of properly completing the system setup procedures?

OUTSTANDING ___ EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT ___

COMMENTS: ____

____

FASTENERS AND CONNECTORS

0006 Do equipment thumbscrews secure satisfactorily?

NO ___ YES ___ if NO, name and describe ____

____

FASTENERS AND CONNECTORS (Cont'd)

0007 Is the equipment designed for easy access to perform maintenance?

NO ___ YES ___ if NO, name and describe ________________

____

COMMUNICATIONS

0008 Is the amount of incoming information at your position too much for one person to handle?

NO ___ YES ___ if YES, name and describe ________________

____

0009 What is your assessment of the ease of understanding information generated by front panel indicators and displays?

OUTSTANDING ___ EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT _

COMMENTS: ________________

____

0010 What is your assessment of the ease of exchanging necessary information with the personnel at other commands on the circuit?

OUTSTANDING ___ EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT _

COMMENTS: ________________

____

OPERATING PROCEDURES AND TASKS

0011 What is your assessment of the ability to operate the equipment satisfactorily using the prescribed procedures?

OUTSTANDING ___ EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT _

COMMENTS: ________________

____

0012 Are there any computations required for operating the equipment which are difficult to use?

NO ___ YES ___ if YES, name and describe ________________

____

OPERATING PROCEDURES AND TASKS (Cont'd)

0013 What is your assessment of the amount of time you are required to expend in monitoring the equipment?

CONTINUOUSLY ___ MOST OF THE TIME ___ HALF OF THE TIME ___

PART OF THE TIME ___ OCCASIONALLY ___

COMMENTS: ______________________________

____

0014 What is your assessment of the ease of operating the equipment while performing the required interactions with other personnel?

OUTSTANDING ___ EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT _

COMMENTS: ______________________________

____

0015 What is your assessment of how fatiguing the equipment is to operate?

VERY FATIGUING ___ FATIGUING ___ SOMEWHAT FATIGUING ___

NO IMPACT ___

COMMENTS: ______________________________

____

0016 How many operators per watch do you consider necessary to satisfactorily operate and maintain this system?

List the number of operators required and any comments: ______________________________

____

0017 How much practice time do operators get a week? ___ HOURS

Do you consider this enough? YES ___ NO ___

If NO, how many hours do you recommend? ___ HOURS

____

0018 What is your confidence in the performance of this equipment?

OUTSTANDING ___ EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT _

COMMENTS: ______________________________

____

OPERATING PROCEDURES AND TASKS (Cont'd)

0019 Do you consider your rating appropriate for operating this equipment?

NO ___ YES ___

COMMENTS: ____

____

0020 What is your assessment of log keeping required of you as an operator?

EASY TO DO ___ INTERFERING ___ TOO DIFFICULT ___ NOT APPLICABLE ___

COMMENTS: ____

____

COMPATIBILITY

0021 Record any instance of the system's inability to operate in its intended environment. Include effects from vibration, radiation, power fluctuation, temperature, etc. ______________

____

INTEROPERABILITY

0022 Record any instance of the system's inability to operate with other components such as antennas, modems, cryptographic equipment, patch panels, etc. ______________

____

SAFETY AND DISTRACTIONS

0023 What is your assessment of any equipment created reflection or glare that will cause problems with safety or distractions?

NO EFFECT ___ SOME EFFECT ___ UNSAT EFFECT ___

COMMENTS: ____

____

0024 Are the actual techniques used in operating the equipment the same as those provided in the operating manual?

NO ___ YES ___ if NO, name and describe ______________________

____

SAFETY AND DISTRACTIONS (Cont'd)

0025 How would you assess the safety of exposed equipment edges and corners?

ROUGH AND UNSAFE ___ CLEAN AND SAFE ___

COMMENTS: ______________________________

0026 Are the units in the system mounted so that you can gain access to them without danger from electrical charge, heat, moving parts, radiation, or other hazards?

NO ___ YES ___ if NO, name and describe ______________________________

0027 Have all the tools and test leads to be used near high voltages been adequately insulated?

NO ___ YES ___ if NO, name and describe ______________________________

0028 Have guards, grounds, interlocks, and warning placards been provided to minimize the possibility of exposing personnel to dangerous voltages or radiation where necessary?

NO ___ YES ___ if NO, name and describe ______________________________

0029 Does technical documentation provide adequate explanations of the hazards of radiation, and procedures to be followed to avoid exposure?

NO ___ YES ___ if NO, name and describe ______________________________

0030 Do you think that established operating and maintenance procedures provide adequate protection against electrical shock, radiation, exposure, or equipment damage?

NO ___ YES ___ if NO, name and describe ______________________________

0031 What is your overall impression of the safety aspects provided by this equipment?

VERY SAFE ___ SAFE ___ UNSAFE ___ (If UNSAFE, in what way?)

____

SAFETY AND DISTRACTIONS (Cont'd)

0032 List ways in which equipment safety could be improved.

____

____

TRAINING AND EXPERIENCE

0033 Prior operation/maintenance experience with similar equipment would be ____ to the operator.

EXTREMELY HELPFUL ___ SOMEWHAT HELPFUL ___ HELPFUL ___ NO HELP _

COMMENTS: ____

____

0034 Does the information generated by the system require a particular skill, not received in training, in order to operate this system?

NO ___ YES ___ if YES, name and describe ______________________

____

0035 What is your assessment of the training you have received?

OUTSTANDING ___ EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT _

COMMENTS: ____

____

0036 What is your assessment of required on-the-job training after completion of formal training?

MANDATORY ___ NICE TO HAVE ___ NOT REQUIRED ___

COMMENTS: ____

____

0037 Was your training for interpreting information generated by the system adequate for your operator tasks?

NO ___ YES ___ if NO, name and describe ______________________

____

TRAINING AND EXPERIENCE (Cont'd)

0038 How would you assess the adequacy of formal training received on the manipulation of equipment controls?

OUTSTANDING ___ EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT _

COMMENTS: ____

____

0039 Do you have any suggestions for additions/changes to the operator/maintenance training that would be of help to the operator/maintainer?

COMMENTS: ____

____

0040 Provide any comments you feel would aid in making the system more valuable to the fleet.

____

____

____

____
Signature

Date: ________

LOGISTICS SUPPORTABILITY QUESTIONNAIRE
(To be completed by Maintenance Personnel)

0001 Rate the adequacy of the SINCGARS ILSP and ULSS..

ILSP: EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT ___

OLSS: EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT ___

How would you improve on either? ______________________________

____

0002 Rate the adequacy of the all technical manuals and PMS documentation.

TM: EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT ___

PMS: EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT ___

How would you improve on either? ______________________________

____

0003 Were all General Purpose Electronic Test Equipment (GPETE), APL, and spare parts onboard as required by the SINCGARS ILSP/ULSS and Technical Manuals?

Yes ___ No ___

If No, explain ______________________________

____

0004 Rate the adequacy of calibration requirements and stowage space for spare parts.

Calibration: EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT ___

Stowage: EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT ___

____

0005 Rate the availability and adequacy of the AN/ARQ-53, GPETE, and special tools.

AN/ARQ-53: EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT ___

GPETE: EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT ___

Special Tools: EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT ___

____

____
Signature

APPENDIX C

AN/ARQ-53 DT-IIB TESTING SCHEDULE

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Table C-1. AN/ARQ-53 DT-IIB Testing Schedule and Data Responsibility

Test	Event	Days	Dates	Responsibility	
				Providing Data	Analyzing/ Verifying
	Prerequisite Test: Groom System	Note	Note	TD	TD
E-1	Range	10	March - May	S/H/G	TD
E-2	Survivability	90	March - May	H	TD
E-3	Electromagnetic Compatibility	90	March - May	S/H/G	TD
S-1	Reliability	90	March - May	S/H/G	TD
S-2	Maintainability	90	March - May	EMO	TD
S-3	Availability	90	March - May	S/H/G	TD
S-4	Logistics Supportability	90	March - May	S/H/G	TD
S-5	Compatibility	90	March - May	S/H/G	TD
S-6	Interoperability	90	March - May	H	TD
S-7	Training Requirements	90	March - May	H	TD
S-8	Human Factors	90	March - May	H	TD
S-9	Safety	90	March - May	H	TD
S-10	Documentation	90	March - May	H	TD

Legend: TD - Test Director; S/H/G - Ship/Helo/Ground Unit; EMO - Electronic Maintenance Officer

Note: The AN/ARQ-53 system operational checks should be performed following its installation in the helicopter and prior to helicopter deployments from the USS SIAPAN.

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APPENDIX B

DT-IIB Situation Reports (SITREPs) 1 - 5

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For Jim Key -
Sit Reps #1 & 2
+
Freq Ext Msg.

RBR

Pg 1 of 6

PRIORITY

P 261905Z APR 96

FM USS SAIPAN

TO COMSPAWARSYSCOM WASHINGTON DC//PMW 176-21G//

INFO COMOPTEVFOR NORFOLK VA//N3/N4/N5/N6/N8//
NISEEAST CHARLESTON SC//431TT/532//

UNCLAS //N03965//

MSGID//GENADMIN/USS SIAPAN/-/APR//

SUBJ/CNO PROJECT 0706-01 AND 0706-02 NAVY SINGLE CHANNEL GROUND AND AIRBORNE RADIO SYSTEM (SINCGARS) DT-IIB TECHNICAL EVALUATION SITREP NO. 1//

REF/A/DOC/TEMP 0706-01

REF/B/DOC/TEMP 0706-02

REF/C/DOC/TP 0706-01

REF/D/DOC/TP 0706-02

NARR/REFS A AND B ARE TEST AND EVALUATION MASTER PLANS (TEMPS) FOR NAVY SINCGARS SHIPMENT (AN/SRC-54) AND AIRBORNE RELAY SEGMENT (AN/ARQ-53) RESPECTIVELY. REFS C AND D ARE TEST PLANS (TP) FOR THE AN/SRC-54 AND AN/ARQ-53 RESPECTIVELY.//
POC/V. KOPEK/TEST DIRECTOR/NISEEAST (532VK)/-/TEL: (804) 485-6422
TEL:DSN 961-6422 EXT 322/FAX (804) 487-7349//

RMKS/1. THE FOLLOWING SYSTEM PERFORMANCE DATA IS PROVIDED IAW REFS A THRU D.

2. NAVY SINCGARS DT-IIB PROGRESS/STATUS AS OF 261700Z APR 96
2.A. AN/SRC-54 EFFECTIVENESS TESTS (E-TESTS):
2.A.1. RANGE (TEST E-1): 40NMI SHIP-SHIP BETWEEN SHIP B AND C IN SC AND FH MODES EACH IN PT AND CT. ERF WAS ALSO ACCOMPLISHED AT THIS RANGE.
2.A.2. SURVIVABILITY (TEST E-2): NO PROBLEM ENCOUNTERED.

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2.A.3. ELECTROMAGNETIC COMPATIBILITY (TEST E-3): NO PROBLEM EN NTERED.

2.B. AN/SRC-54 SUITABILITY TESTS (S-TESTS)

2.B.1. RELIABILITY (TEST S-1): NO PROBLEM ENCOUNTERED

2.B.2. MAINTAINABILITY (TEST S-2): NO PROBLEM ENCOUNTERED

2.B.3. AVAILABILITY (TEST S-3): 100 PERCENT

2.B.4. LOGISTIC SUPPORTABILITY (TEST S-4): NO PROBLEM ENCOUNTERED

2.B.5. COMPATIBILITY (TEST S-5): NO PROBLEM ENCOUNTERED

2.B.6. INTEROPERABILITY(TEST S-6): NO PROBLEM ENCOUNTERED

2.B.7. TRAINING (TEST S-7): OJT ONGOING

2.B.8. HUMAN FACTORS (TEST S-8): NO PROBLEM ENCOUNTERED

2.B.9. SAFETY (TEST S-9): NO PROBLEM ENCOUNTERED

2.B.10. DOCUMENTATION (TEST S-10): NO PROBLEM ENCOUNTERED

3. TEST DIRECTOR COMMENTS: ARQ-53 RELAY TESTING FOR PERIOD OF 27 THRU 30 APRIL 96 TERMINATED DUE TO CHANGE IN SCHEDULE OF SHIP A. RELAY HAS BEEN REMOVED FM SHIP A PENDING AVAILABILITY FOR ADDL TESTING.

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PRIORITY

P 282200Z APR 96

FM USS SAIPAN

TO COMSPAWARSYSCOM WASHINGTON DC//PMW 176-21G//

INFO COMOPTEVFOR NORFOLK VA//N3/N4/N5/N6/N8//
NISEEAST CHARLESTON SC//431TT/532//

UNCLAS //N03965//

MSGID/GENADMIN/USS SAIPAN/-/APR//

SUBJ/CNO PROJECT 0706-01 AND 0706-02 NAVY SINGLE CHANNEL GROUND AND AIRBORNE RADIO SYSTEM (SINCGARS) DT-IIB TECHNICAL EVALUATION SITREP NO. 2//

REF/A/DOC/TEMP 0706-01

REF/B/DOC/TEMP 0706-02

REF/C/DOC/TP 0706-01

REF/D/DOC/TP 0706-02

NARR/REFS A AND B ARE TEST AND EVALUATION MASTER PLANS (TEMPS) FOR NAVY SINCGARS SHIPMENT (AN/SRC-54) AND AIRBORNE RELAY SEGMENT (AN/ARQ-53) RESPECTIVELY. REFS C AND D ARE TEST PLANS (TP) FOR THE AN/SRC-54 AND AN/ARQ-53 RESPECTIVELY.//
POC/V. KOPEK/TEST DIRECTOR/NISEEAST (532VK)/-/TEL: (804) 485-6422 TEL:DSN 961-6422 EXT 322/FAX (804) 487-7349//

RMKS/1. THE FOLLOWING SYSTEM PERFORMANCE DATA IS PROVIDED IAW REFS A THRU D.

2. NAVY SINCGARS DT-IIB PROGRESS/STATUS AS OF 281700Z APR 96
2.A. AN/SRC-54 EFFECTIVENESS TESTS (E-TESTS):
2.A:1. RANGE (TEST E-1): 42 NMI SHIP-SHORE FM SHIP B AND 12 TO 41 NMI FM SHIP C TO SHORE. BOTH LINKS ACCOMPLISHED IN SC AND FH MODES EACH IN PT AND CT. ERF WAS ACCOMPLISHED AT 30 NMI. SHORE CONFIG WAS AN/VRC-90A WITH 50W OUTPUT.

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2.A.2. SURVIVABILITY (TEST E-2): NO PROBLEM ENCOUNTERED.
2.. . ELECTROMAGNETIC COMPATIBILITY (TEST E-3): NO PROBLEM ENCOUNTERED.
2.B. AN/SRC-54 SUITABILITY TESTS (S-TESTS)
2.B.1. RELIABILITY (TEST S-1): NO PROBLEM ENCOUNTERED
2.B.2. MAINTAINABILITY (TEST S-2): NO PROBLEM ENCOUNTERED
2.B.3. AVAILABILITY (TEST S-3): 100 PERCENT
2.B.4. LOGISTIC SUPPORTABILITY (TEST S-4): NO PROBLEM ENCOUNTERED
2.B.5. COMPATIBILITY (TEST S-5): NO PROBLEM ENCOUNTERED
2.B.6. INTEROPERABILITY (TEST S-6): NO PROBLEM ENCOUNTERED
2.B.7. TRAINING (TEST S-7): OJT ONGOING
2.B.8. HUMAN FACTORS (TEST S-8): NO PROBLEM ENCOUNTERED
2.B.9. SAFETY (TEST S-9): NO PROBLEM ENCOUNTERED
2.B.10. DOCUMENTATION (TEST S-10): NO PROBLEM ENCOUNTERED

3. TEST DIRECTOR COMMENTS: EXAMINING POSSIBILITY FOR ARQ-53 RELAY TEST ON 14 MAY 96 BETWEEN FT STORY AND SHIPS AT SEA. RELAY IS CURRENTLY LOCATED AT NISE EAST DET NORFOLK PENDING AVAILABILITY FOR TEST.

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418 4437 SENCOR, INC. 001/002

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PRIORITY . ROUTINE

P F)11900Z APR 96

FM USS SAIPAN

TO COMSPAWARSYSCOM WASHINGTON DC//PMW 176-21G//

INFO COMOPTEVFOR NORFOLK VA//N3/N4/N5/N6/N8//
NISEEAST CHARLESTON SC//431TT/532//

UNCLAS //N03965//

MSGID//GENADMIN/USS SAIPAN/-/APR//

SUBJ/CNO PROJECT 0706-01 AND 0706-02 NAVY SINGLE CHANNEL GROUND AND AIRBORNE RADIO SYSTEM (SINCGARS) DT-IIB TECHNICAL EVALUATION SITREP NO. 3//

REF/A/DOC/TEMP 0706-01

REF/B/DOC/TEMP 0706-02

REF/C/DOC/TP 0706-01

REF 'DOC/TP 0706-02

NARR/REFS A AND B ARE TEST AND EVALUATION MASTER PLANS (TEMPS) FOR NAVY SINCGARS SHIPMENT (AN/SRC-54) AND AIRBORNE RELAY SEGMENT (AN/ARQ-53) RESPECTIVELY. REFS C AND D ARE TEST PLANS (TP) FOR THE AN/SRC-54 AND AN/ARQ-53 RESPECTIVELY.//
POC/V. KOPEK/TEST DIRECTOR/NISEEAST (532VK)/-/TEL: (804)485-6422
TEL:DSN 961-6422 EXT 322/FAX (804) 487-7349//

RMKS/1. THE FOLLOWING SYSTEM PERFORMANCE DATA IS PROVIDED IAW REFS A THRU D.

2. NAVY SINCGARS DT-IIB PROGRESS/STATUS AS OF 301700Z APR 96
2.A. AN/SRC-54 EFFECTIVENESS TESTS (E-TESTS):
2.A.1. RANGE (TEST E-1): 20 TO 42 NMI SHIP-SHIP AND 28 TO 35 NMI SHIP-SHORE. COMMS ACCOMPLISHED IN SC AND FH MODES, EACH IN PT AND CT. ERF ACCOMPLISHED AT 28 NMI. SHORE CONFIG IS AN/VRC-90A WITH 50W OUTPUT. 10 TO 12 NMI SHORE-SHIP WITH SHORE IN HI AND MED POWER OUTPUT RANGES.

for JIM KEY
-RPT #3

PG 1 of 2

Post-it Fax Note 7671 Date Pages
To B. DREWS From
Co./Dept. VITRO Co.
Phone # (703) 553-1407 Phone #
Fax # (703) 553-1424 Fax #

/122
Date In: 05/01/96

301900Z APR 96
Time In: 06:15:16

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2.A.2. SURVIVABILITY (TEST E-2): NO PROBLEM ENCOUNTERED.
2.A.3. ELECTROMAGNETIC COMPATIBILITY (TEST E-3): NO PROBLEM ENCOUNTERED.
2.B. AN/SRC-54 SUITABILITY TESTS (S-TESTS)
2.B.1. RELIABILITY (TEST S-1): NO PROBLEM ENCOUNTERED
2.B.2. MAINTAINABILITY (TEST S-2): NO PROBLEM ENCOUNTERED
2.B.3. AVAILABILITY (TEST S-3): 100 PERCENT
2.B.4. LOGISTIC SUPPORTABILITY (TEST S-4): NO PROBLEM ENCOUNTERED
2.B.5. COMPATIBILITY (TEST S-5): NO PROBLEM ENCOUNTERED
2.B.6. INTEROPERABILITY(TEST S-6): NO PROBLEM ENCOUNTERED
2.B.7. TRAINING (TEST S-7): OJT ONGOING
2.B.8. HUMAN FACTORS (TEST S-8): NO PROBLEM ENCOUNTERED
2.B.9. SAFETY (TEST S-9): NO PROBLEM ENCOUNTERED
2.B.10. DOCUMENTATION (TEST S-10): NO PROBLEM ENCOUNTERED

3. TEST DIRECTOR COMMENTS: NONE.

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RIORITY ROUTINE

R 031748Z MAY 96

M USS SAIPAN

O COMSPAWARSYSCOM WASHINGTON DC//PMW 176-21G//

NFO COMOPTEVFOR NORFOLK VA//N3/N4/N5/N6/N8//
NISEEAST CHARLESTON SC//431TT/532//

UNCLASS //N03965//

MSGID//GENADMIN/USS SAIPAN/-/MAY//

SUBJ/CNO PROJECT 0706-01 AND 0706-02 NAVY SINGLE CHANNEL GROUND
/AND AIRBORNE RADIO SYSTEM (SINCGARS) DT-IIB TECHNICAL EVALUATION
/SITREP NO. 4//

REF/A/DOC/TEMP 0706-01

REF/B/DOC/TEMP 0706-02

REF/C/DOC/TP 0706-01

REF/D/DOC/TP 0706-02

NARR/REFS A AND B ARE TEST AND EVALUATION MASTER PLANS (TEMPS)
FOR NAVY SINCGARS SHIPMENT (AN/SRC-54) AND AIRBORNE RELAY SEGMENT
(AN/ARQ-53) RESPECTIVELY. REFS C AND D ARE TEST PLANS (TP) FOR
THE AN/SRC-54 AND AN/ARQ-53 RESPECTIVELY.//
POC/V. KOPEK/TEST DIRECTOR/NISEEAST (532VK)/-/TEL: (804)485-6422
/TEL:DSN 961-6422 EXT 322/FAX (804) 487-7349//

RMKS/1. THE FOLLOWING SYSTEM PERFORMANCE DATA IS PROVIDED IAW
REFS A THRU D.

2. NAVY SINCGARS DT-IIB PROGRESS/STATUS AS OF 021700Z MAY 96
2.A. AN/SRC-54 EFFECTIVENESS TESTS (E-TESTS):
2.A.1. RANGE (TEST E-1): 14 TO 20 NMI SHIP-SHIP ACCOMPLISHED
SINCE LAST SITREP. COMMS ACCOMPLISHED IN SC PT AND CT INCLUDING
USE OF OK-637 SINCGARS REMOTE UNITS.
2.A.2. SURVIVABILITY (TEST E-2): NO PROBLEM ENCOUNTERED.

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.A.3. ELECTROMAGNETIC COMPATIBILITY (TEST E-3): NO PROBLEM
COUNTERED.

.B. AN/SRC-54 SUITABILITY TESTS (S-TESTS)

.B.1. RELIABILITY (TEST S-1): 13,020 HRS OF OPERATION
CUMULATED FOR DT-IIB TEST PLATFORMS.

.B.2. MAINTAINABILITY (TEST S-2): NO PROBLEM ENCOUNTERED.

.B.3. AVAILABILITY (TEST S-3): 100 PERCENT.

.B.4. LOGISTIC SUPPORTABILITY (TEST S-4): AN/SRC-54 PMS, GPETE,
LSP, ULSS, NTP, IS ON HAND ON ALL DT-IIB SHIPS.

.B.5. COMPATIBILITY (TEST S-5): SYSTEM COMPATIBLE WITH SAS/BAS
ND KY-58'S. SHIPS COOLING SYSTEMS CONTINUE TO SUPPORT SYSTEM
PERATION.

.B.6. INTEROPERABILITY(TEST S-6): SYSTEM HAS SUCCESSFULLY
OMMUNICATED WITH AN/VRC-12 FAMILY ON LCU'S AND VHF EQUIPMENT ON
CAC'S IN SC VOICE AND SC/FH CT AND PT VOICE WITH SINCGARS
N/VRC-90A.

.B.7. TRAINING (TEST S-7): OJT ONGOING, 17 HRS TO DATE.

.B.8. HUMAN FACTORS (TEST S-8): POSITIVE INFORMAL COMMENTS
ECEIVED FM EMBARKED MARINES CONCERNING OK-637 AND EASE OF
ONTROLLING AND MONITORING THEIR COMM CKTS. HUMAN FACTORS
UESTIONNAIRES HAVE BEEN PROVIDED TO PERSONNEL ON SHIPS B AND C.

.B.9. SAFETY (TEST S-9): NO PROBLEM ENCOUNTERED.

.B.10. DOCUMENTATION (TEST S-10): NO PROBLEM ENCOUNTERED.

3. TEST DIRECTOR COMMENTS: EMBARKED MARINES HAVE INFORMALLY
REQUESTED TEST DIRECTOR TO INVESTIGATE MEANS OF PROVIDING REMOTE
SINCGARS CAPABILITIES TO EMBARKED COMMANDER STATEROOM.
ADDITIONAL OK-637 IS RECOMMENDED FOR DEBARK CONTROL FOR MORE
EFFICIENT USE OF RADIO ASSETS.

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IORITY ROUTINE

R 050030Z MAY 96

M USS SAIPAN

O COMSPAWARSYSCOM WASHINGTON DC//PMW 176-21G//

NFO COMOPTEVFOR NORFOLK VA//N3/N4/N5/N6/N8//
ISEEAST CHARLESTON SC//431TT/532//

NCLAS //N03965//

SGID//GENADMIN/USS SAIPAN/-/MAY//

UBJ/CNO PROJECT 0706-01 AND 0706-02 NAVY SINGLE CHANNEL GROUND AND AIRBORNE RADIO SYSTEM (SINCGARS) DT-IIB TECHNICAL EVALUATION SITREP NO. 5//

EF/A/DOC/TEMP 0706-01

REF/B/DOC/TEMP 0706-02

REF/C/DOC/TP 0706-01

REF/D/DOC/TP 0706-02

NARR/REFS A AND B ARE TEST AND EVALUATION MASTER PLANS (TEMPS) FOR NAVY SINCGARS SHIPMENT (AN/SRC-54) AND AIRBORNE RELAY SEGMENT (AN/ARQ-53) RESPECTIVELY. REFS C AND D ARE TEST PLANS (TP) FOR THE AN/SRC-54 AND AN/ARQ-53 RESPECTIVELY.//
POC/V. ROPER/TEST DIRECTOR/NISEEAST (532VK)/-/TEL: (804)485-6422 /TEL:DSN 961-6422 EXT 322/FAX (804) 487-7349//

RMKS/1. THE FOLLOWING SYSTEM PERFORMANCE DATA IS PROVIDED IAW REFS A THRU D.

2. NAVY SINCGARS DT-IIB PROGRESS/STATUS AS OF 041900Z MAY 96
2.A. AN/SRC-54 EFFECTIVENESS TESTS (E-TESTS):
2.A.1. RANGE (TEST E-1): 21 NMI SHIP-SHIP AND 17 NMI SHIP-SHORE WITH AN/PRC-119 ON SHORE ACCOMPLISHED SINCE LAST SITREP. COMMS DEMONSTRATED IN SC PT AND CT INCLUDING USE OF OX-537 REMOTE UNITS.

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A.2. SURVIVABILITY (TEST E-2): NO PROBLEM ENCOUNTERED.
A.3. ELECTROMAGNETIC COMPATIBILITY (TEST E-3): NO PROBLEM
COUNTERED.
B. AN/SRC-54 SUITABILITY TESTS (S-TESTS)
.B.1. RELIABILITY (TEST S-1): 14,820 HRS OF OPERATION
CUMULATED FOR DT-IIB TEST PLATFORMS.
.B.2. MAINTAINABILITY (TEST S-2): NO PROBLEM ENCOUNTERED.
.B.3. AVAILABILITY (TEST S-3): 100 PERCENT.
.B.4. LOGISTIC SUPPORTABILITY (TEST S-4): AN/SRC-54 AND AN/ARQ-
3 PMS, GPETE, ILSP, ULSS, NTP, ARE ON HAND ON ALL DT-IIB SHIPS.
.B.5. COMPATIBILITY (TEST S-5): SYSTEM COMPATIBLE WITH SAS/BAS
ND KY-58'S. SHIPS COOLING SYSTEMS CONTINUE TO SUPPORT SYSTEM
PERATION.
.B.6. INTEROPERABILITY(TEST S-6): COMMS CONTINUE TO
UCCESSFULLY COMMUNICATE WITH AN/VRC-12 FAMILY ON LCU'S, AN/PRC-
19 MANPACK, AND LCAC VHF EQUIPMENT IN SC VOICE IN PT AND CT.
C/FH CT AND PT VOICE ESTABLISHED WITH AN/VRC-90A AND OTHER
N/SRC-54'S.
.B.7. TRAINING (TEST S-7): OJT ONGOING, 24 HRS TO DATE.
.B.8. HUMAN FACTORS (TEST S-8): HUMAN FACTORS QUESTIONNAIRES
AVE BEEN PROVIDED TO PERSONNEL ON ALL THREE DT-IIB PLATFORMS.
.B.9. SAFETY (TEST S-9): NO PROBLEM ENCOUNTERED.
.B.10. DOCUMENTATION (TEST S-10): NO PROBLEM ENCOUNTERED.

. TEST DIRECTOR COMMENTS: POTENTIAL SOLUTION TO SUPPORT U.S.
ARINE REQUESTS FOR REMOTE SINCGARS CAPABILITIES TO EMBARKED
COMMANDER AND DEBARK CONTROL MAY BE THE ARMY SINCGARS CONTROL
MONITOR. INVESTIGATION ONGOING.

BT

APPENDIX C

AN/ARQ-53 Initial Flight Test Report of 12 January 1994

Post-it® Fax Note 7671	Date 6/12/96 # of pages ▸
To BOB DREWS	From DALE MOUNCE
Co./Dept.	Co.
Phone #	Phone # 317-306-2905
Fax # 703-553-1424	Fax # 317-306-4373

AN/ARQ-53

Shipboard SINCGARS Relay System

Test Report

Initial Flight Test

12 January 1994

Prepared for:
Space and Naval Warfare Systems Command
PMW 172-11D
Arlington, VA 22245

Prepared by:
Naval Air Warfare Center Aircraft Division
SINCGARS Team, Code 11X337C61
Indianapolis, IN 46219

Warren W. Glen.,
Electrical Engineer

NAWCAD Report Number: 11X337C-95-001

1. INTRODUCTION

This report documents the initial flight test of the Radio Repeater Set, AN/ARQ-53, commonly known as the Relay, for the US Navy Shipboard SINCGARS program. This test was conducted at NAWCAD Patuxent River MD. Aircraft and facilities were provided by NAWCAD Patuxent River with additional test equipment provided by NAWCAD Indianapolis and NISE-EAST Detachment Norfolk.

1.1 Purpose of the Test

The purpose of this test was to provide functional performance data of the AN/ARQ-53 Relay during an actual flight scenario at various ranges. This information will be used in future tests to conduct maximum range tests. This test was performed in support of SPAWAR Statement of Work PMW 152-11D-062-95. This report is prepared in accordance with CDRL T006 and DID DI-NDTI-80604.

1.2 Item Tested

Nomenclature	Radio Repeater Set, AN/ARQ-53
Model or Part Number	91E2N100
Type of Test Item	Engineering Development Model
Serial Number	X003
Applicable Engineering Changes	First AC/DC Model
Developmental Specification	SPAWAR-S-839
Date of Manufacture	October 1994

1.3 Test Requirements

The test was intended to determine range/performance data with one and two circuit operation using single channel and frequency hopping modes of operation.

2. SUMMARY

This test represents the first flight of the Radio Repeater Set, AN/ARQ-53, more commonly known as the Shipboard SINCGARS Relay System. While limited in the amount of information gathered, the test did establish that the relay can perform at greater than specified ranges in both single channel (SC) and frequency-hopping (FH) modes of operation. Frequency Hopping was conducted using a FH net which was thought to be full band. It turns out that the nets were very narrow band nets (72 nets) and this caused degradation of the signal. Bit error rate (BER) information was gathered primarily in the full-band FH mode using 16 Kbps data.

3. REFERENCES

SPAWAR-S-836 15 August 1990	Shipboard Single Channel Ground and Airborne Radio System (SINCGARS) System Specification
SPAWAR-S-839 25 March 1991	Shipboard Single Channel Ground and Airborne Radio System (SINCGARS) Relay Segment Specification

Test Support Plan, Shipboard
Single Channel Ground and Airborne Relay System
31 October 1994

There was a isolation between the two base antennas of approximately 45 dB. The mobile station was located in a HUMMV approximately 75 yards from the base station.

4.3 Test Procedures

a) A range call was made from the aircraft on the UHF radio.
b) UHF communication between base and mobile ensuring that the SINCGARS radios are in the same mode.
c) Bi-directional communications between the base and mobile units through the AN/ARQ-53 to evaluate the link..
d) UHF communication with the aircraft to change radio configurations during flight if necessary (only needed in this test when changing between frequency hopping and single channel operation).
e) Additional testing was conducted through the relay from the transmitter at the base station to a receiver at the base station. This link was used to evaluate the BER performance of the relay.

4.4 Test Results and Analysis

4.4.1 Recorded Data

a) Voice Quality

TIME	RANGE N-Miles	MODE	Base Quality	NOTES	Mobile Quality
11/15/94 10:15	15	FH	FAIR - broken		
11/15/94 10:16	15	FH	GOOD		
11/15/94 10:17	15	FH	FAIR - broken		
11/15/94 10:10	20	FH	POOR-broken		
11/15/94 11:25	20	FH		INBOUND	
11/15/94 10:21	25	FH	POOR - broken	MOBILE RANGE VERY BROKEN	Poor R/W
11/15/94 10:30	30	FH	FAIR - broken	RCV 1/ XMT 2	Fair R
11/15/94 10:17	20-22	FH	None	MOBILE RANGE LOST	
11/15/94 10:24	30+	FH	POOR - broken	RCV 1/ XMT 3	Poor R/W
11/15/94 10:31	30+	FH	FAIR - broken	RCV 2/ XMT 2	
11/15/94 10:27	35 Rot	FH	POOR - broken	RCV 2/ XMT 2	
11/15/94 10:37	37	SC	POOR - strong	RCV 2/ XMT 2	Fair R/B
11/15/94 10:40	40	SC	POOR - strong	RCV 2/ XMT 2	Fair R/B
11/15/94 10:49	43	SC	Loud/Clear	RCV 2/ XMT 2	Good L/C
11/15/94 10:41	45	SC	POOR - strong	RCV 2/ XMT 2	Poor W/B
11/15/94 10:43	50	SC	POOR - strong	RCV 2/ XMT 2 - TURNING BACK	
11/15/94 10:44	50	SC	GOOD - strong	RCV 2/ XMT 2 - HEADING 350	
11/15/94 10:13	15-20	SC		NOT OPERATIONAL	
11/15/94 10:33	30-35	SC	FAIR	RCV 2/ XMT 2	Fair

4) BER in the single channel operating mode exceed spec and in some aircraft orientations were exceptional.
5) Communication was possible out to 50 n-miles in the single channel mode with good results when the airframe was inbound.
6) FH Communication was fair/slightly broken at 30 n-miles when the airframe was inbound. This was for a two way link and exceeds spec for the shore to relay link and is close to spec for the ship to relay link.

4.5 Conclusions

a) Reception at the airframe seemed to be the most critical link. Antenna location is very important for 360 degree operation. CH-46 antenna locations MUST be identified with this in mind.
b) All watches must be synchronized at start of test to allow for easier analysis of the data.
c) Additional separation is necessary between the mobile and base stations to help prevent co-site interference.
d) All RTs must be in the data off mode of operation when testing audio quality.
e) Different frequency hopping nets should be tried to see if there is an improvement in performance..

4.6 Recommendations

A second flight test is planned using the UH-1N platform. Using the data from the first test flight the second flight will try varying platform orientations to determine the optimum heading. Once the best heading is determined additional BER data will be taken at varying ranges. To gauge the differences between different nets one circuit will be configured for full band nets and the second circuit will be configured at the same 5% separation nets used in DAT testing. Points from the conclusions learned will be incorporated as possible in the second test.

5. CERTIFICATIONS

5.1 Certification of Test Results

The data presented above is an accurate representation of the data collected.

6. APPENDICES

Attached are the data sheets from the flight test.

APPENDIX D

AN/ARQ-53 Second Flight Test Report of 8 February 1995

AN/ARQ-53

Shipboard SINCGARS Relay System

Test Report

Second Flight Test

8 February 1995

Prepared for:
Space and Naval Warfare Systems Command
PMW 172-11D
Arlington, VA 22245

Prepared by:
Naval Air Warfare Center Aircraft Division
SINCGARS Team, Code 11X337C61
Indianapolis, IN 46219

Keith A. Williams,
Team Leader

Warren W. Glen.,
Electrical Engineer

1. INTRODUCTION

This report documents the second flight test of the Radio Repeater Set, AN/ARQ-53, commonly known as the Relay, for the US Navy Shipboard SINCGARS program. This test was conducted at NAWCAD Patuxent River MD. Aircraft and facilities were provided by NAWCAD Patuxent River with additional test equipment provided by NAWCAD Indianapolis.

1.1 Purpose of the Test

The purpose of this test was to provide functional performance data of the AN/ARQ-53 Relay during an actual flight scenario at various ranges and aircraft orientations. An additional purpose was to gather rough maximum range information using the optimum aircraft orientation. This information will be used in future tests to conduct more detailed maximum range tests and to determine if the antenna locations of the UH-1N need to be changed. This test was performed in support of SPAWAR Statement of Work PMW 172-11D-062-95. This report is prepared in accordance with CDRL T006 and DID DI-NDTI-80604.

1.2 Item Tested

Nomenclature	Radio Repeater Set, AN/ARQ-53
Model or Part Number	91E2N100
Type of Test Item	Engineering Development Model
Serial Number	X001
Applicable Engineering Changes	DC Model
Developmental Specification	SPAWAR-S-839
Date of Manufacture	May 1994

1.3 Test Requirements

The test was intended to determine range/performance data with one and two circuit operation using single channel and frequency hopping modes of operation. In addition to range/performance data this test is necessary to gather antenna performance information.

2. SUMMARY

This test represents the second flight of the Radio Repeater Set, AN/ARQ-53, more commonly known as the Shipboard SINCGARS Relay System. While limited in the amount of information gathered, the test confirmed that the relay can perform at greater than specified ranges in both single channel (SC) and frequency-hopping (FH) modes of operation. Frequency Hopping was conducted using a FH net which was thought to be full band along with the 5% separation nets used in DAT. It turns out that the nets thought to be full band were very narrow band nets (72 nets) and this caused degradation of the signal. These narrow band nets were not used to gather data during this test flight. Bit error rate (BER) information was gathered primarily in the 5% separation FH mode using 16 Kbps data.

3. REFERENCES

SPAWAR-S-836 15 August 1990 — Shipboard Single Channel Ground and Airborne Radio System (SINCGARS) System Specification

SPAWAR-S-839 25 March 1991 — Shipboard Single Channel Ground and Airborne Radio System (SINCGARS) Relay Segment Specification

31 October 1994 — Test Support Plan, Shipboard Single Channel Ground and Airborne Relay System

4. REPORT

4.1 Test Equipment Identification

a) Base Station

One RT-1523/VRC used for transmission

One RT-1523/VRC used for reception

One ARC-210 UHF radio for communication with aircraft

One AN/ARQ-53 Test Set Interface Unit

One Firebird MC6000 Communications Analyzer S/N 16113

Two AS-3900 Antennas

4.2 Test facility installation and set-up

a) Frequencies used during this test were as follows:

1) FH1	F499
2) FH2	F450
3) FH3	F100
4) FH4	F200
5) SC1	49.950 MHz
6) SC2	63.000 MHz
7) SC3	49.950 MHz
8) SC4	63.000 MHz
9) BASE - UH-1N	233.8 MHz

NOTE: F499 and F450 were not full band hopsets as believed. They were very narrow band hopsets with 72 Freq in the net.

b) Radios were loaded with the following presets

1) AN/ARQ-53

RT1	FH1. SC1
RT2	FH2, SC2
RT3	FH3, SC3
RT4	FH4, SC4

2) Base Station

Xmit RT	FH1, FH3, SC1, SC3
Rcv RT	FH2, FH4, SC2, SC4

c) The base antenna used for transmission was located on top of a hundred foot pole located at the shore line. The base receive antenna was located on the roof of the antenna range, approximately 60 ft high. There was a isolation between the two base antennas of approximately 45 dB. The receive antenna was located on the port side of the aircraft and the transmit antenna on the starboard side.

d) The spectrum analyzer was hooked up to an additional antenna to sample the transmitted and received signals along with the background environment.

4.3 Test Procedures

The following steps were used to conduct the performance tests:

a) The aircraft proceeded to a range of 20 n-miles from the base station at a bearing of approximately 170. The aircraft then proceeded to remain at this range and hover at various headings in 45 degree increments.

b) At each heading BER information was gathered using a transmission power level of 4 watts and 50 watts at the transmitter. This information gave the optimum platform orientation (heading of 45 degrees) used in testing at various ranges.

c) The aircraft then proceeded to stations at 40 and 60 n-miles and hovered at a heading of 45 degrees allowing BER and audio quality information to be gathered at each range.

d) The aircraft then proceeded to return to the airfield heading approximately 350 degrees (Toward the base station) and BER and audio quality was taken at 5 n-mile increments.

e) Additional testing was conducted through the relay from the transmitter at the base station to a receiver at the base station. This link was used to evaluate the BER performance of the relay.

f) Spectrum analyzer information was gathered throughout the test.

4.4 Test Results and Analysis

4.4.1 Recorded Data

The following tables depict the data gathered during this flight:

a) Voice Quality

Range	Power	Bearing	Heading	Mode	Audio
20	4	170	45	Freq Hop	LC
20	50	170	350	Freq Hop	LC
20	50	170	45	Freq Hop	LC
25	50	170	350	Freq Hop	LC
30	50	170	350	Freq Hop	LC
35	50	170	350	Freq Hop	LC
40	4	170	90	Freq Hop	RN
40	4	170	45	Freq Hop	RN
40	50	170	45	Freq Hop	LC
40	50	170	90	Freq Hop	LN
45	50	170	350	Freq Hop	RN
60	4	170	45	Single Channel	LC
60	4	170	45	Freq Hop	UR
60	50	170	45	Freq Hop	BRB
60	50	170	45	Single Channel	LC

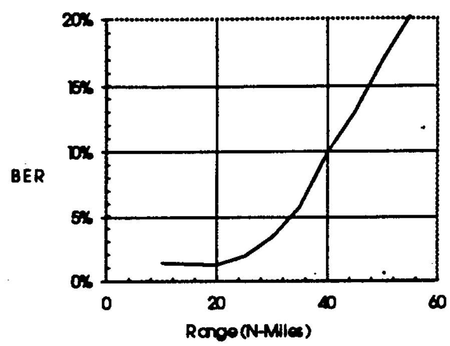
b) Bit Error Rates

Range	Power	Bearing	Heading	BER	Comments
10	50	170	350	1.34E-02	Inbound
20	4	170	45	1.17E-02	
20	4	170	90	1.59E-02	
20	4	170	135	2.57E-02	
20	4	170	180	7.14E-02	
20	4	170	225	3.97E-02	
20	4	170	270	2.24E-02	
20	4	170	315	4.35E-02	
20	4	170	360	2.67E-02	
20	50	170	45	3.63E-03	
20	50	170	90	6.09E-03	
20	50	170	135	1.41E-02	
20	50	170	180	2.78E-02	
20	50	170	225	1.82E-02	
20	50	170	270	2.39E-02	
20	50	170	315	2.42E-02	
20	50	170	350	1.27E-02	Inbound
20	50	170	360	1.14E-02	
25	50	170	350	1.96E-02	Inbound
30	50	170	350	3.38E-02	Inbound
35	50	170	350	5.57E-02	Inbound
40	4	170	45	7.27E-02	
40	4	170	90	3.10E-02	4800BPS
40	4	170	90	9.83E-02	
40	50	170	45	5.46E-02	
40	50	170	90	8.53E-03	4800BPS
40	50	170	90	7.73E-02	
40	50	170	350	9.87E-02	Inbound
45	50	170	350	1.30E-01	Inbound
50	50	170	350	1.70E-01	Inbound
55	50	170	350	2.01E-01	Inbound
60	4	170	45	3.18E-02	Single Channel
60	4	170	45	1.60E-01	Mixed Mode
60	50	170	45	1.45E-02	Single Channel
60	50	170	45	1.60E-01	
60	50	170	45	1.63E-01	
60	50	170	350	No Link	Inbound

4.4.2 Test Results

Orientation of the platform with respect to the transmitting station had a very pronounced affect on the BER perfoemance of the relay. The best performance was obtained with the receive antenna on the platform orientated twoard the transmitting station. The orientation of the aircraft with the receive antenna twoard the transmitting station placed the transmitting antenna at the worst orientation for the communications link. This orientation shows that there is no problem with the transmission from the relay.

The data also shows that the BER in frequency hopping mode does not meet the technical specification of 10^{-2} @ 16000 BPS but it suggest that the system might meet the operational requirements of proviging a DCT-DCT link. If the data rate is lowered to 4800 BPS the BER performance improves significently. The DCT-DCT Link will need to be check in a future series of flight tests.



AN/ARQ-53 Inbound Flight Profile
With 5% Separtation Nets

The quality of the voice communication was generally very good at ranges exceeding specified ranges of 15 and 35 n-miles. Voice communication in frequency hopping mode was good out to 40 n-miles in low power and 60 n-miles in high power. In single channel mode low and high power were both loud and clear out to 60 n-miles.

4.5 Conclusions

a) Reception at the airframe seemed to be the most critical link. The best reception was with the receive antenna on the airframe facing the transmitting station (airframe at 45 degree heading). Antenna location is very important for 360 degree operation. CH-46 antenna locations MUST be identified with this in mind.

b) Additional tests need to be conducted with DCTs providing the communication links and the two sites in a inline orientation to simulate the operational scenario.

c) Full band frequency hopping nets should be tried to see if there is an improvement in performance.

d) Additional antenna orientations should be tried with the UH-1N.

4.6 Recommendations

Additional flight tests need to be planned using the UH-1N platform. These additional flights will attempt to simulate the operational environment using DCT stations. A man portable radio will be used as the mobile station to simulate the ground user and the same base station equipment will be used to simulate the ship. Depending on the results of these operational tests antenna location changes may be incorporated and additional test run using the above scenario.

5. CERTIFICATIONS

5.1 Certification of Test Results

The data presented above is an accurate representation of the data collected.

6. APPENDICES

Attached are the data sheets from the flight test.

T

Moble_____ / Base_____ Date_______________

Power Output | Power Input

50w

Time 1:33
Range.......... 20
Bearing.........
Heading....... 360
BER .... 1.41×10^{-2}

Operating Mode		
1	Full Band	
2	5% Sep	X
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

---

4 watt

Time 1:34
Range.......... 20
Bearing.........
Heading....... 360
BER .... 2.67×10^{-2}

Operating Mode		
1	Full Band	
2	5% Sep	
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

---

50 watt

Time 1:38
Range.......... 20
Bearing.........
Heading....... 045
BER .... 3.63×10^{-3}

Operating Mode		
1	Full Band	
2	5% Sep	X
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

---

4 watt

Time 1:39
Range.......... 20
Bearing.........
Heading....... 045
BER .... ~~3.63×10^{-3}~~ 1.17×10^{-2}

Operating Mode		
1	Full Band	
2	5% Sep	X
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

---

50 WATT

Time .... ~~1:39~~ 1:40
Range.......... 20
Bearing......... 090
Heading.......
BER 6.08E-3

Operating Mode		
1	Full Band	
2	5% Sep	X
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

---

4 WATT

Time 1:43
Range.......... 20
Bearing......... 090
Heading.......
BER 1.54E-2

Operating Mode		
1	Full Band	
2	5% Sep	X
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

Data Recorded By: [signature] Date: 12/21/94
Witnessed By: [signature] Date: 12/21/94

(2)

Power output

Power Input

Moble_____ / Base_____ Date____________

---

4 W

Time 1:45
Range.......... 20
Bearing........ 135
Heading.......
BER 2.57E-2

Operating Mode		
1	Full Band	
2	5% Sep	X
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

---

50 W

Time 1:46
Range.......... 20
Bearing........ 135
Heading.......
BER 1.41E-2

Operating Mode		
1	Full Band	
2	5% Sep	X
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

---

50 W

Time 1:47
Range.......... 20
Bearing........
Heading....... 180
BER .... 2.78×10^{-2}

Operating Mode		
1	Full Band	
2	5% Sep	X
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

---

4 W

Time 1:48
Range.......... 20
Bearing........
Heading....... 180
BER .... 7.14×10^{-2}

Operating Mode		
1	Full Band	
2	5% Sep	X
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

---

50 W

Time 1:53
Range.......... 20
Bearing........
Heading....... 225
BER .... 1.82×10^{-2}

Operating Mode		
1	Full Band	
2	5% Sep	X
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

---

4 W

Time 155
Range.......... 20
Bearing........
Heading....... 225
BER .... 3.97×10^{-2}

Operating Mode		
1	Full Band	
2	5% Sep	X
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

Data Recorded By: [signature] Date: 12/21/94
Witnessed By: [signature] Date: 12/21/94

(3)

Moble_____ / Base_____ Date___________

50 W

Time: 1:57
Range: 20
Bearing:
Heading: 270
BER: 2.39×10^{-2}

Operating Mode		
1	Full Band	
2	5% Sep	X
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

4 W

Time: 1:58
Range: 20
Bearing:
Heading: 270
BER: 2.24×10^{-2}

Operating Mode		
1	Full Band	
2	5% Sep	X
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

50 W

Time: 2:00
Range: 20
Bearing:
Heading: 315
BER: 2.42×10^{-2}

Operating Mode		
1	Full Band	
2	5% Sep	X
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

4 W

Time: 2:02
Range: 20
Bearing:
Heading: 315
BER: 4.35×10^{-2}

Operating Mode		
1	Full Band	
2	5% Sep	X
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

50 W

Time:
Range: 20
Bearing:
Heading: 45°
BER:

Operating Mode		
1	Full Band	
2	5% Sep	X
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud	X	Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

4 W

Time: 2:05
Range: 20
Bearing:
Heading:
BER:

Operating Mode		
1	Full Band	
2	5% Sep	
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud	~~X~~	Clear	
Readable	X	Noisy	
Bearly Readably		Broken	X
Unreadable			

Data Recorded By: Wayne W. [signature] Date: 12/21/94
Witnessed By: James [signature] Date: 12/21/94

(4)

Moble_____ / Base_____ Date______________

50W

Time: 2:21
Range: 40
Bearing:
Heading: 45
BER: 5.46×10^{-2}

Operating Mode		
1	Full Band	
2	5% Sep	X
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

4W

Time: 223
Range: 40
Bearing:
Heading: 45
BER: 7.27×10^{-2}

Operating Mode		
1	Full Band	
2	5% Sep	X
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

4W

Time: 2:24
Range: 40
Bearing:
Heading: 45
BER:

Operating Mode		
1	Full Band	
2	5% Sep	X
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable	X	Noisy	X
Bearly Readably		Broken	
Unreadable			

50W

Time: 2:24
Range: 40
Bearing:
Heading: 45
BER:

Operating Mode		
1	Full Band	
2	5% Sep	X
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud	X	Clear	X
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

50W

Time: 225
Range: 40
Bearing: ~~90~~
Heading: 90
BER: 7.73×10^{-2}

Operating Mode		
1	Full Band	
2	5% Sep	X
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

4W

Time: 226
Range: 40
Bearing:
Heading: 90
BER: 9.83×10^{-2}

Operating Mode		
1	Full Band	
2	5% Sep	X
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

Data Recorded By: [signature] Date: 12/21/94
Witnessed By: [signature] Date: 12/21/94

Clear + Sunny. TEMP APPROX 55° F

5

Moble_____ / Base_____ Date______________

50W

Time 2:27
Range.......... 40
Bearing........
Heading....... 90
BER .... 8.53×10^{-3}

Operating Mode		
1	Full Band	
2	5% Sep	X
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

4800 bps

4w

Time 2:28
Range.......... 40
Bearing........
Heading....... 90
BER .... 3.10×10^{-2}

Operating Mode		
1	Full Band	
2	5% Sep	X
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

4800bps

4w

Time 2:29
Range.......... 40
Bearing........
Heading....... 90
BER ....

Operating Mode		
1	Full Band	
2	5% Sep	X
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable	X	Noisy	X
Bearly Readably		Broken	
Unreadable			

50W

Time 2:29
Range.......... 40
Bearing........
Heading....... 90
BER ....

Operating Mode		
1	Full Band	
2	5% Sep	X
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud	X	Clear	
Readable		Noisy	X
Bearly Readably		Broken	
Unreadable			

50W

Time .... ~~2:29~~ 2:45
Range.......... 60
Bearing........
Heading....... 45
BER .... 1.60×10^{-1}

Operating Mode		
1	Full Band	
2	5% Sep	X
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

---

50 W

Time 2:45
Range.......... 60
Bearing........
Heading....... 45
BER ....

Operating Mode		
1	Full Band	
2	5% Sep	
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably	X	Broken	X
Unreadable			

Data Recorded By: [signature] Date: 12/21/94
Witnessed By: [signature] Date: 12/21/94

6

Moble_____ / Base_____ Date_____________

4 W

Time 2:46
Range.......... 60
Bearing........
Heading........ 45
BER ....

Operating Mode		
1	Full Band	
2	5% Sep	X
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable	X		

50 W

Time 3:00
Range.......... 60
Bearing........
Heading........ 45
BER .... 1.45×10^{-2}

Operating Mode		
1	Full Band	
2	5% Sep	
3	Single Channel	X
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

4 W

Time 3:02
Range.......... 60
Bearing........
Heading........ 45
BER .... 3.18×10^{-2}

Operating Mode		
1	Full Band	
2	5% Sep	~~X~~
3	Single Channel	X
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

4 W

Time 3:01
Range.......... 60
Bearing........
Heading........ 45
BER ....

Operating Mode		
1	Full Band	
2	5% Sep	~~X~~
3	Single Channel	X
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud	X	Clear	X
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

50 W

Time 3:01
Range.......... 60
Bearing........
Heading........ 45
BER ....

Operating Mode		
1	Full Band	
2	5% Sep	~~X~~
3	Single Channel	X
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud	X	Clear	X
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

4 W

Time 3:02
Range.......... 60
Bearing........
Heading........ 45
BER .... 3~~18~~ 16 E-1

Operating Mode		
1	Full Band	
2	5% Sep	
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	X

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

Data Recorded By: [signature] Date: 12/21/94
Witnessed By: [signature] Date: 12/21/94

7

Moble_____ / Base_____ Date______________

==========

50 w

Time 3:04
Range.......... 60
Bearing........
Heading....... 45
BER .... 1.63x10⁻¹

Operating Mode		
1	Full Band	
2	5% Sep	
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

==========

50 w

Time 3:06
Range.......... 60
Bearing........
Heading....... INBND
BER .... N/L

Operating Mode		
1	Full Band	
2	5% Sep	
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

==========

Time 3:09
Range.......... 55
Bearing........
Heading....... INBND
BER .... 2.01x10⁻¹

Operating Mode		
1	Full Band	
2	5% Sep	
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

==========

Time 3:11
Range.......... 50
Bearing........
Heading....... INBND
BER .... 1.70x10⁻⁷

Operating Mode		
1	Full Band	
2	5% Sep	
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

==========

Time 3:14
Range.......... 45
Bearing........
Heading.......
BER .... 1.37x10⁻¹

Operating Mode		
1	Full Band	
2	5% Sep	
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

==========

Time 3:13
Range.......... 45
Bearing........
Heading....... INBND
BER ....

Operating Mode		
1	Full Band	
2	5% Sep	
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable	X	Noisy	X
Bearly Readably		Broken	
Unreadable			

==========

Data Recorded By: Warren W. Glen Date: 12/2/94
Witnessed By: James Burkhart Date: 12/2/94

8

Moble_____ / Base_____ Date______________

Time 3:16
Range 40
Bearing
Heading WBnd.
BER 9.78×10^{-2}

Operating Mode		
1	Full Band	
2	5% Sep	X
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

Time 3:18
Range 40
Bearing
Heading WBnd
BER

Operating Mode		
1	Full Band	
2	5% Sep	X
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable	X	Noisy	X
Bearly Readably		Broken	
Unreadable .			

Time 3:19
Range 35
Bearing
Heading INBnd.
BER 5.57×10^{-2}

Operating Mode		
1	Full Band	
2	5% Sep	X
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud	X	Clear	X
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

Time 3:21
Range 30
Bearing
Heading INBnd
BER 3.38×10^{-2}

Operating Mode		
1	Full Band	
2	5% Sep	X
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud	X	Clear	X
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

Time 3:23
Range 25
Bearing
Heading INBND
BER 1.96×10^{-2}

Operating Mode		
1	Full Band	
2	5% Sep	
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud	X	Clear	X
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

Time 3:27
Range 20
Bearing
Heading
BER 1.27×10^{-2}

Operating Mode		
1	Full Band	
2	5% Sep	X
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud	X	Clear	X
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

Data Recorded By: [signature] Date: 12/21/94
Witnessed By: [signature] Date: 12/21/94

9

Moble_____ / Base_____ Date______________

Time 3:30
Range.......... 10
Bearing........
Heading.......

BER .... 1.34×10^{-2}

Operating Mode		
1	Full Band	
2	5% Sep	X
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

Time ....
Range..........
Bearing........
Heading.......

BER ....

Operating Mode		
1	Full Band	
2	5% Sep	
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

Time ....
Range..........
Bearing........
Heading.......

BER ....

Operating Mode		
1	Full Band	
2	5% Sep	
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

Time ....
Range..........
Bearing........
Heading.......

BER ....

Operating Mode		
1	Full Band	
2	5% Sep	
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

Time ....
Range..........
Bearing........
Heading.......

BER ....

Operating Mode		
1	Full Band	
2	5% Sep	
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

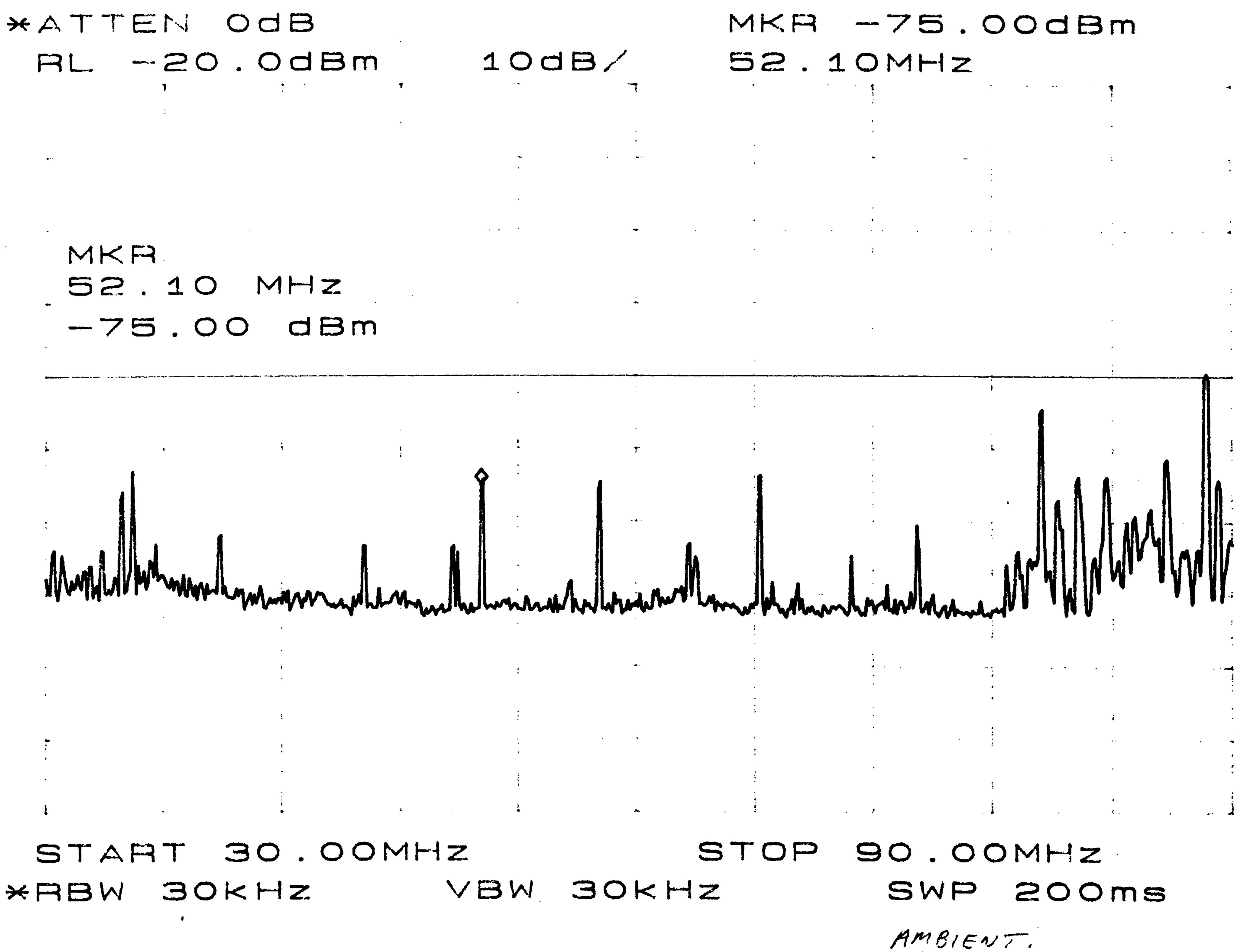
Time ....
Range..........
Bearing........
Heading.......

BER ....

Operating Mode		
1	Full Band	
2	5% Sep	
3	Single Channel	
4	Two Circiut	
5	Mixed Mode	

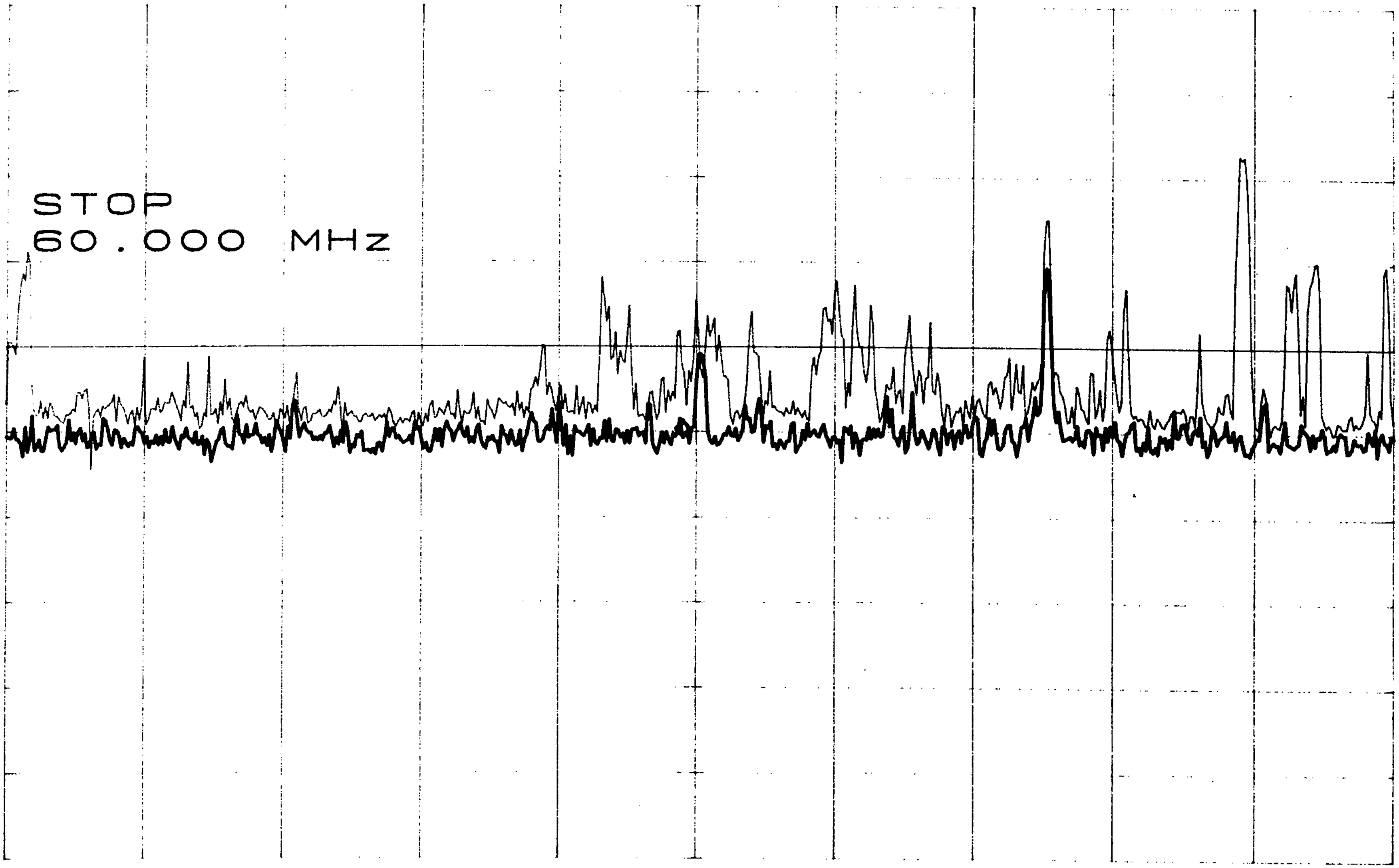
Quality of Voice Signal			
Loud		Clear	
Readable		Noisy	
Bearly Readably		Broken	
Unreadable			

Data Recorded By: [signature] Date: 12/21/94
Witnessed By: [signature] Date: 12/21/94


*ATTEN 0dB
RL -20.0dBm
10dB/
MKR -75.00dBm
52.10MHz
MKR
52.10 MHz
-75.00 dBm
START 30.00MHz
STOP 90.00MHz
*RBW 30kHz
VBW 30kHz
SWP 200ms
AMBIENT.

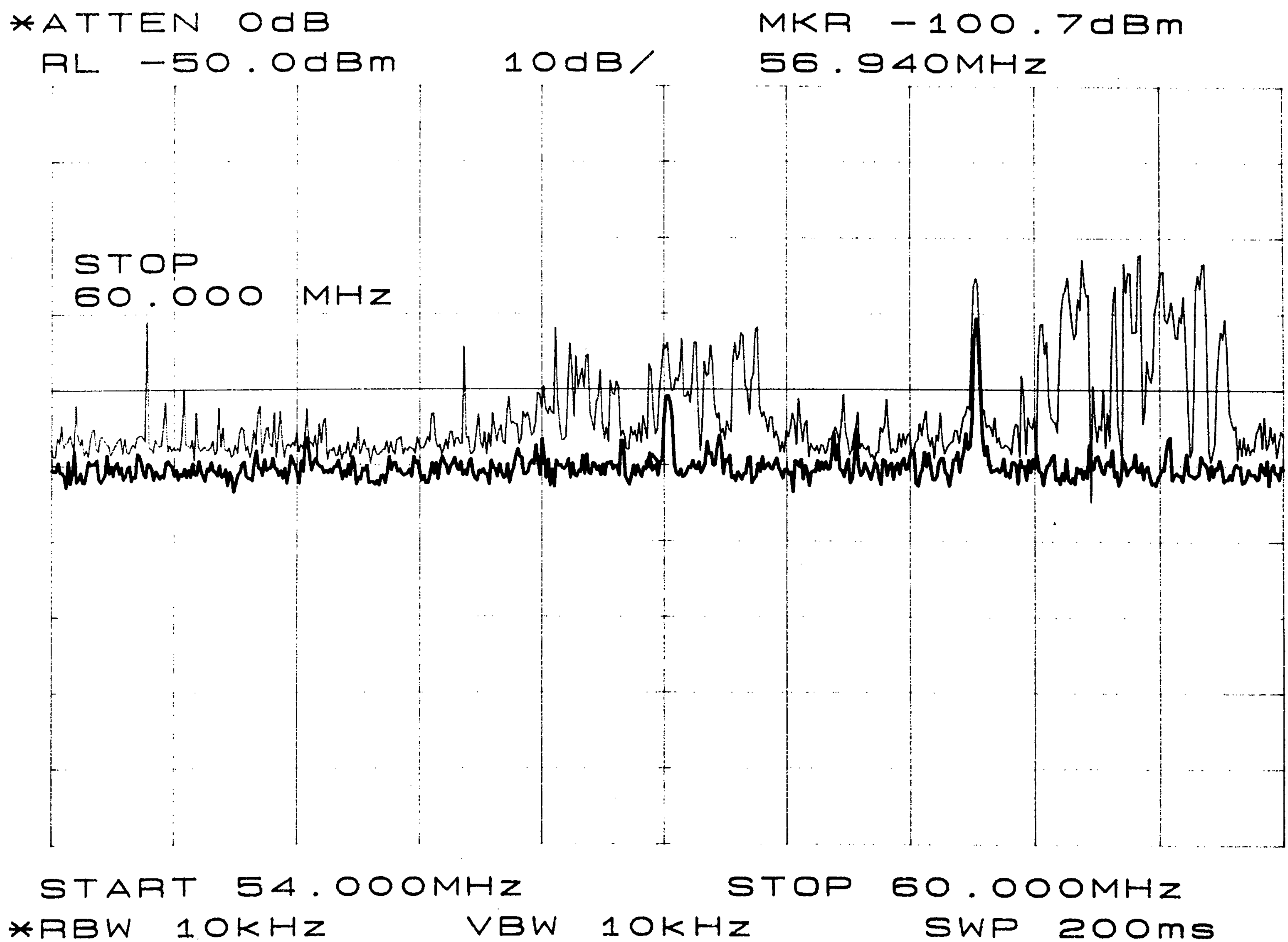
*ATTEN 0dB
RL -50.0dBm 10dB/

MKR -100.7dBm
56.940MHz



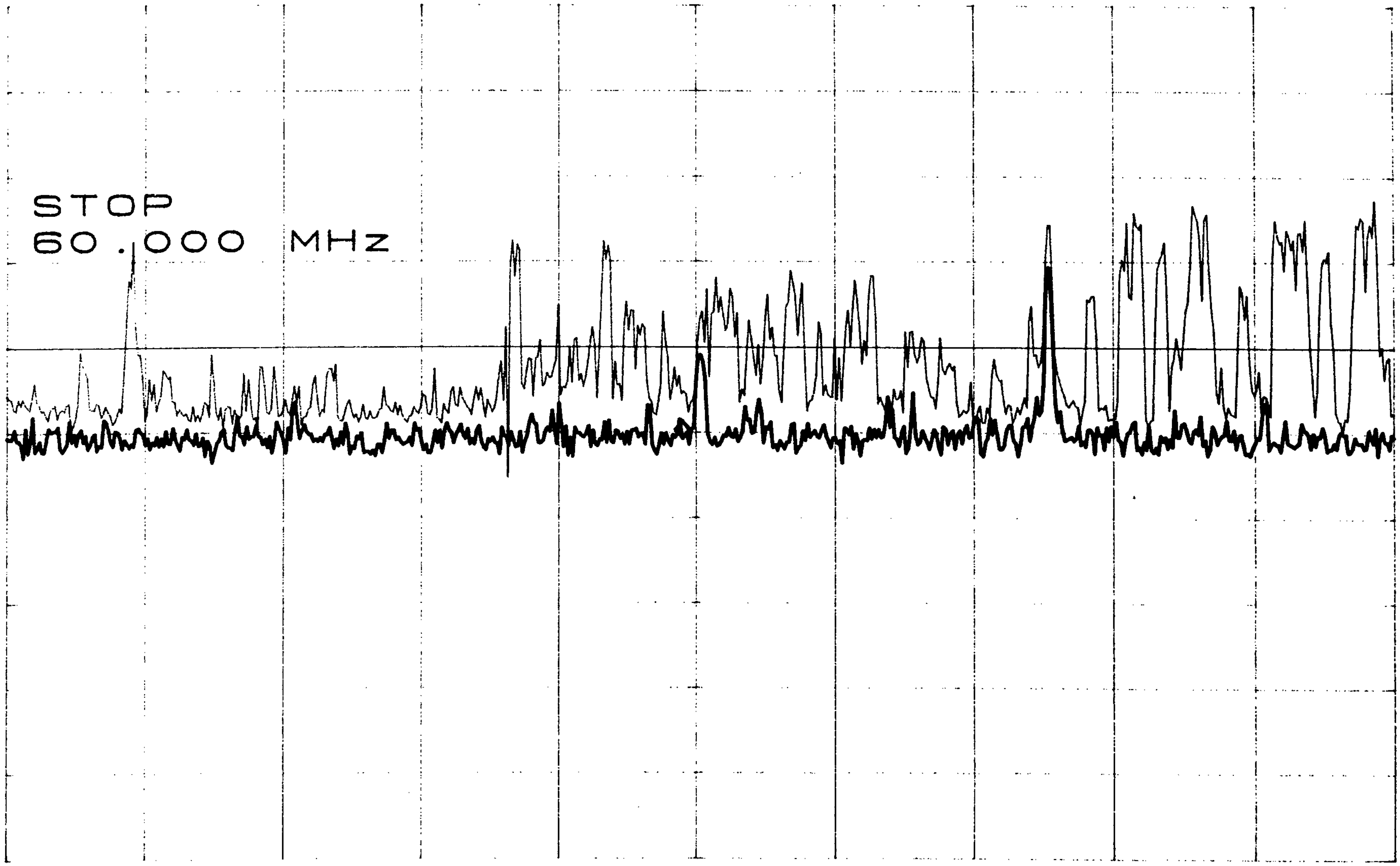
START 54.000MHz STOP 60.000MHz
*RBW 10kHz VBW 10kHz SWP 200ms

55 NM


*ATTEN 0dB
RL -50.0dBm
10dB/
MKR -100.7dBm
56.940MHz
STOP
60.000 MHz
START 54.000MHz
STOP 60.000MHz
*RBW 10kHz
VBW 10kHz
SWP 200ms

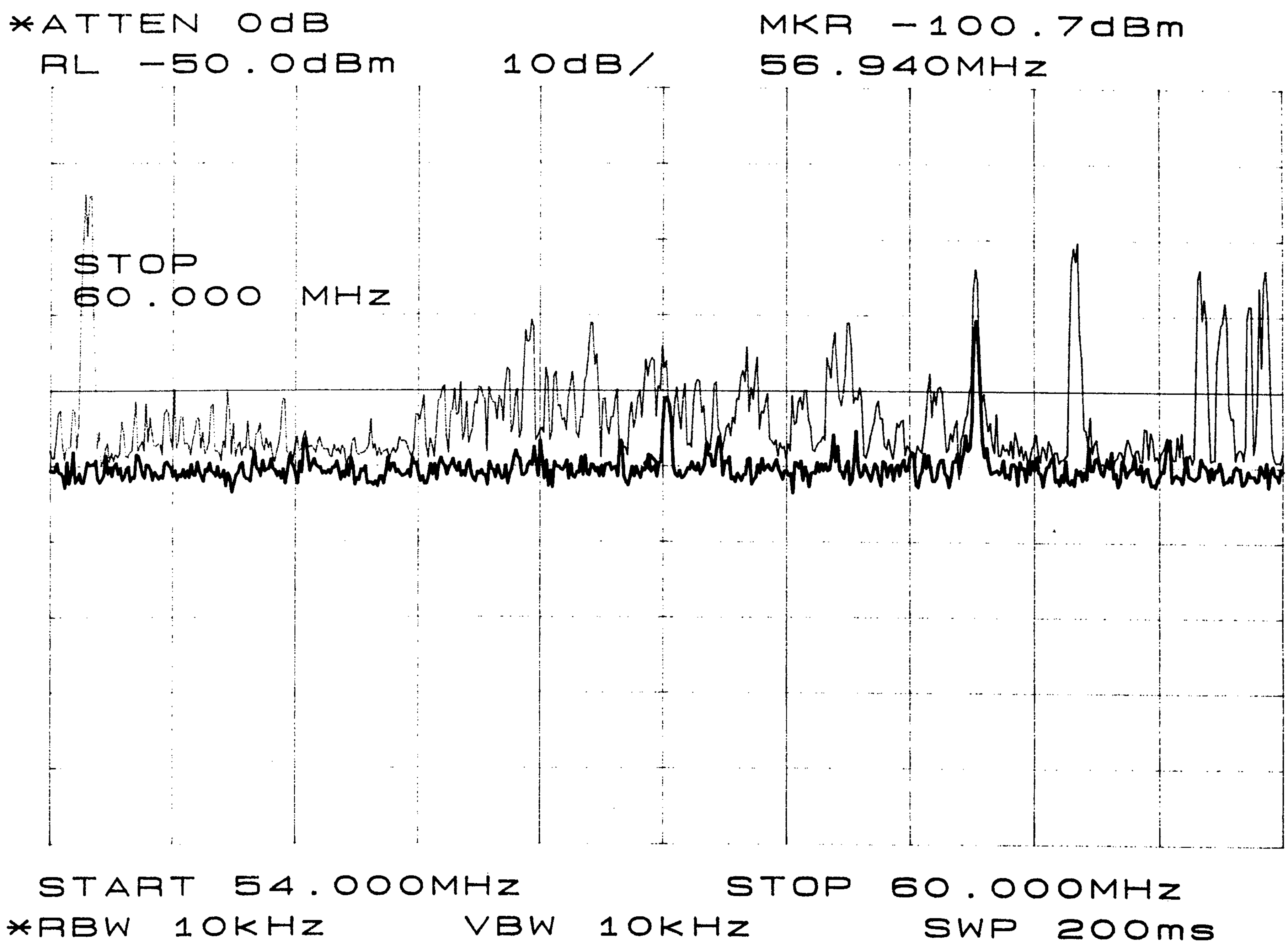
50 NM

*ATTEN 0dB MKR -100.7dBm
RL -50.0dBm 10dB/ 56.940MHz



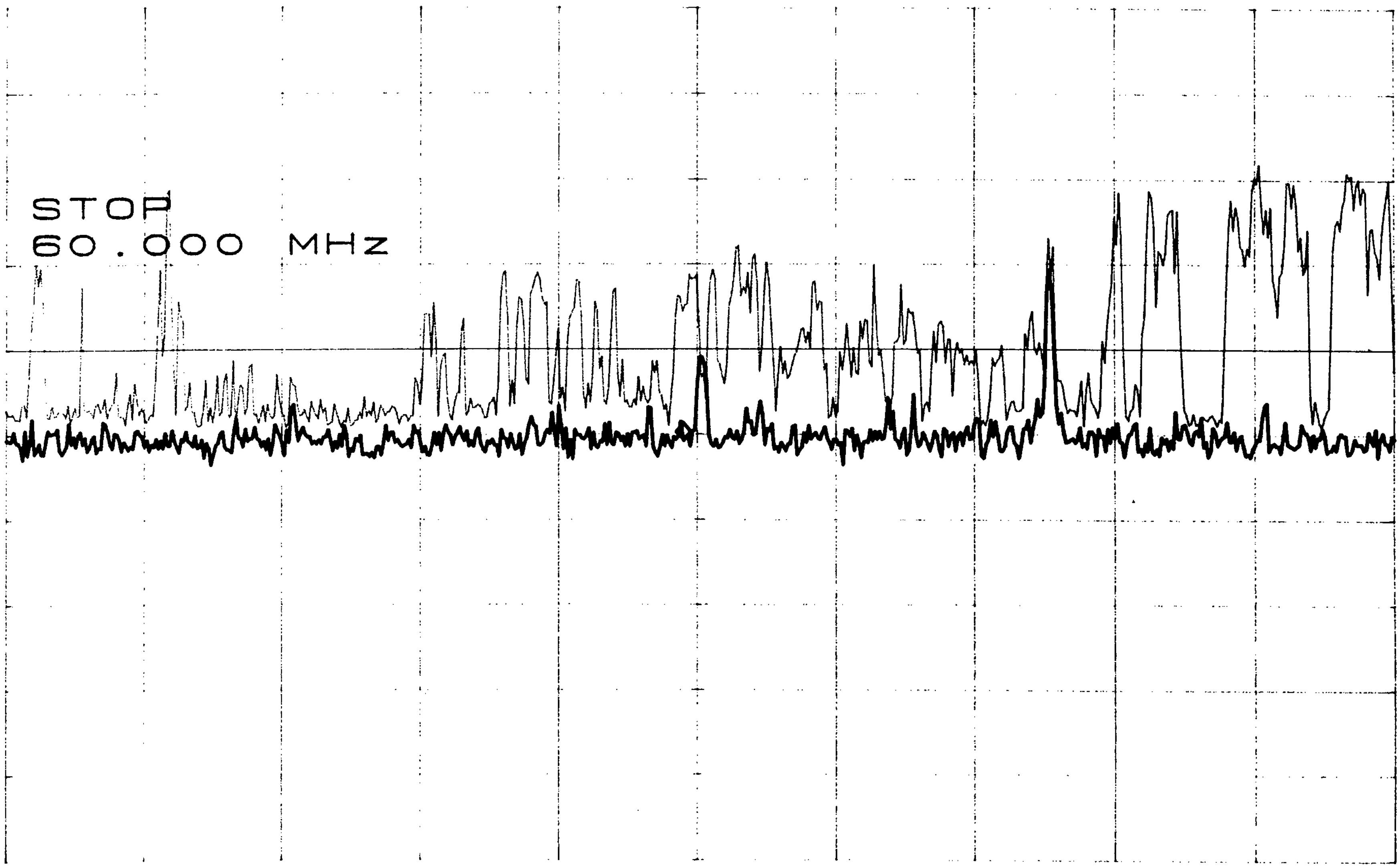
START 54.000MHz STOP 60.000MHz
*RBW 10KHz VBW 10KHz SWP 200ms

40 NM


*ATTEN 0dB
RL -50.0dBm
10dB/
MKR -100.7dBm
56.940MHz
STOP
60.000 MHz
START 54.000MHz
STOP 60.000MHz
*RBW 10kHz
VBW 10kHz
SWP 200ms

30 NM

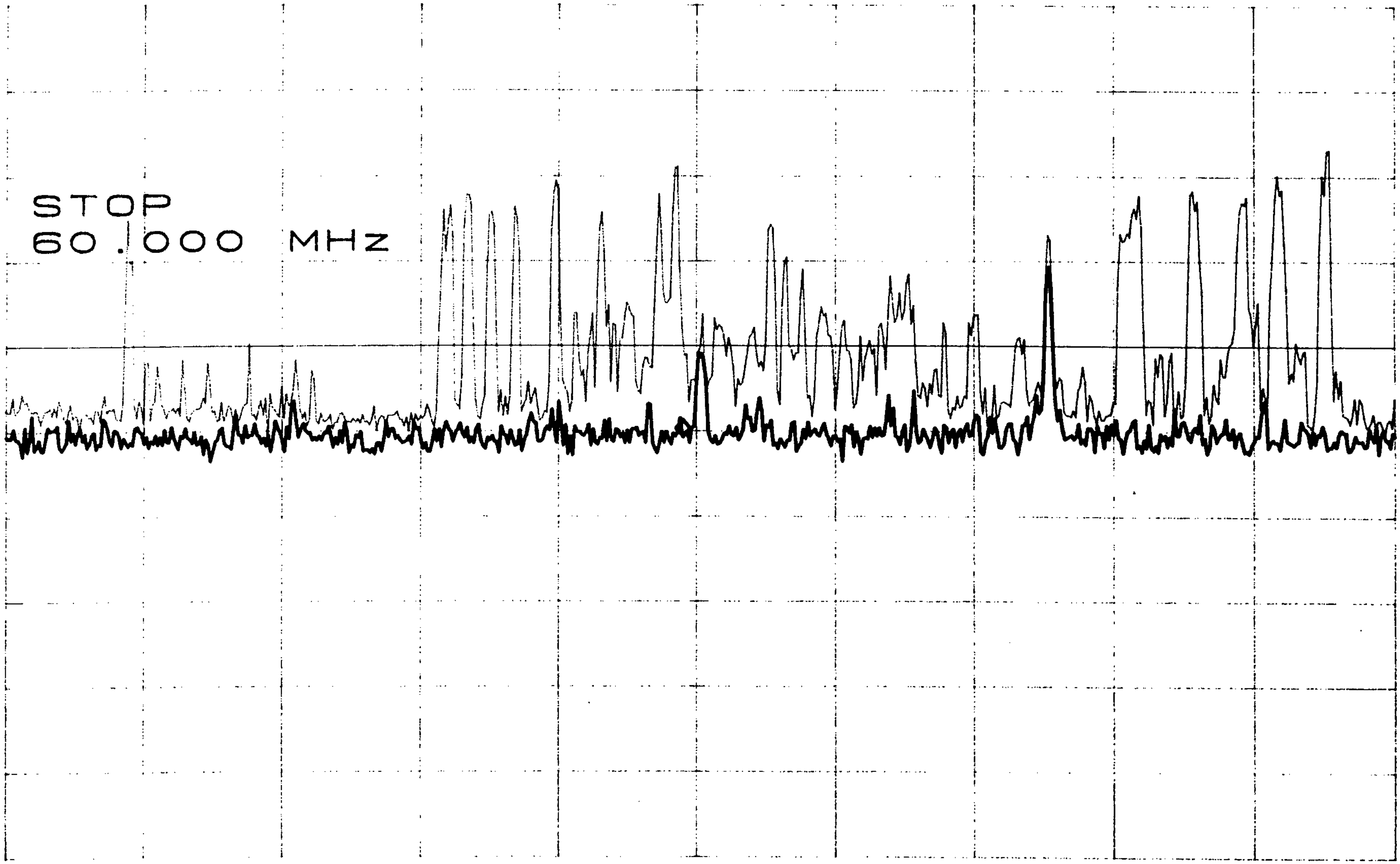
*ATTEN 0dB MKR -100.7dBm
RL -50.0dBm 10dB/ 56.940MHz



START 54.000MHz STOP 60.000MHz
*RBW 10kHz VBW 10kHz SWP 200ms

70 NM

*ATTEN 0dB MKR -100.7dBm
RL -50.0dBm 10dB/ 56.940MHz

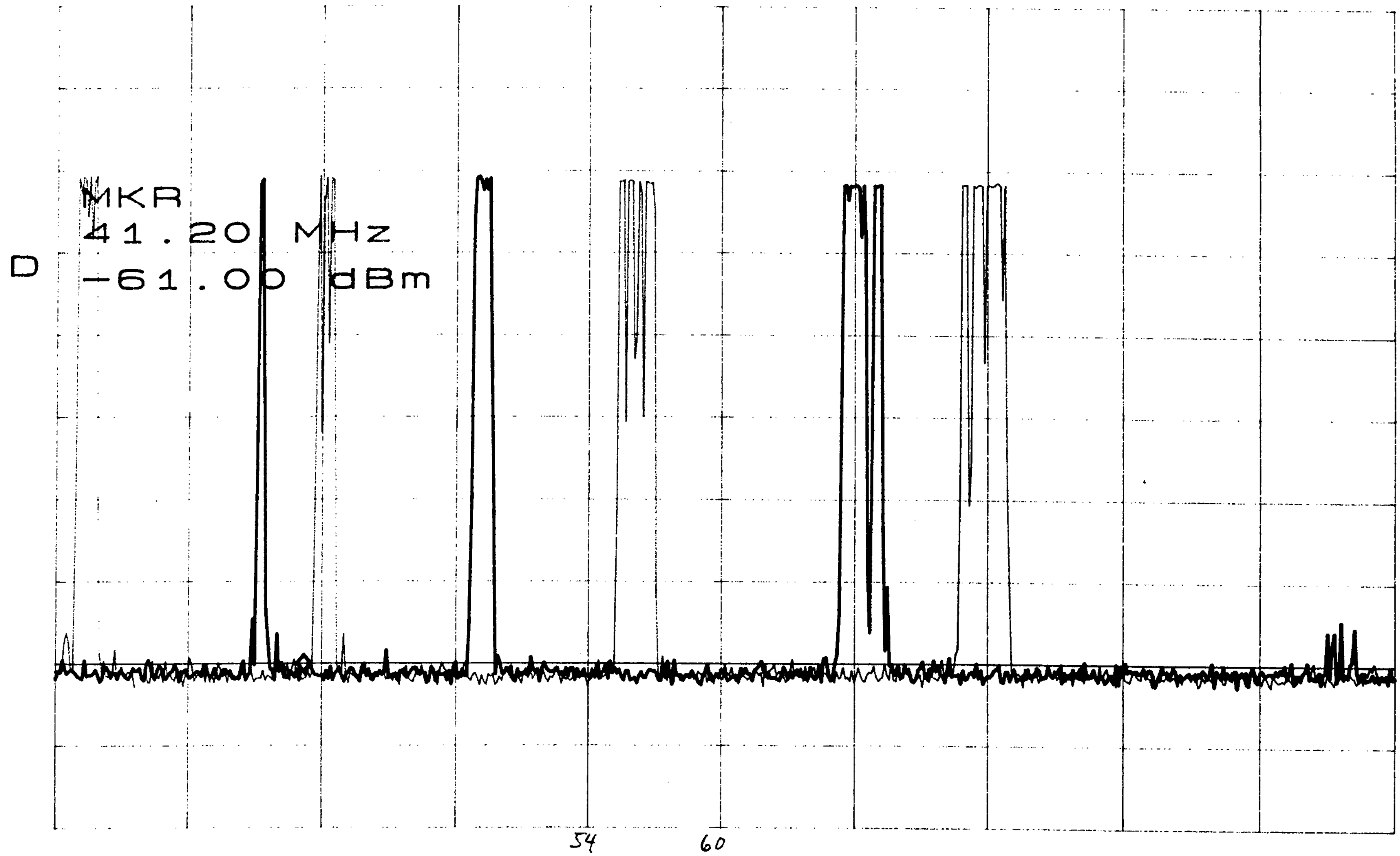


START 54.000MHz STOP 60.000MHz
*RBW 10kHz VBW 10kHz SWP 200ms

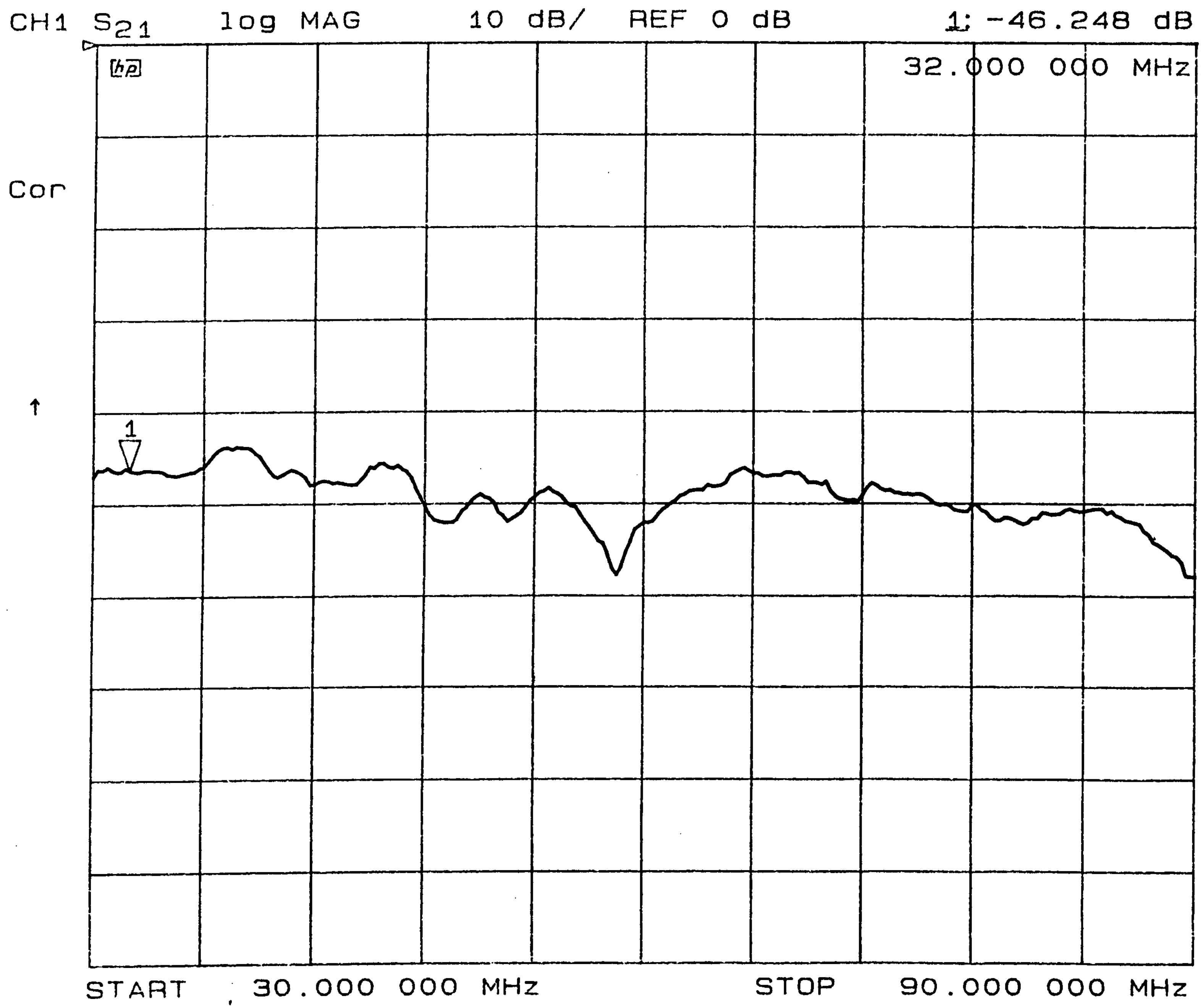
10 NM

*ATTEN 30dB
RL 20.0dBm 10dB/

MKR -61.00dBm
41.20MHz

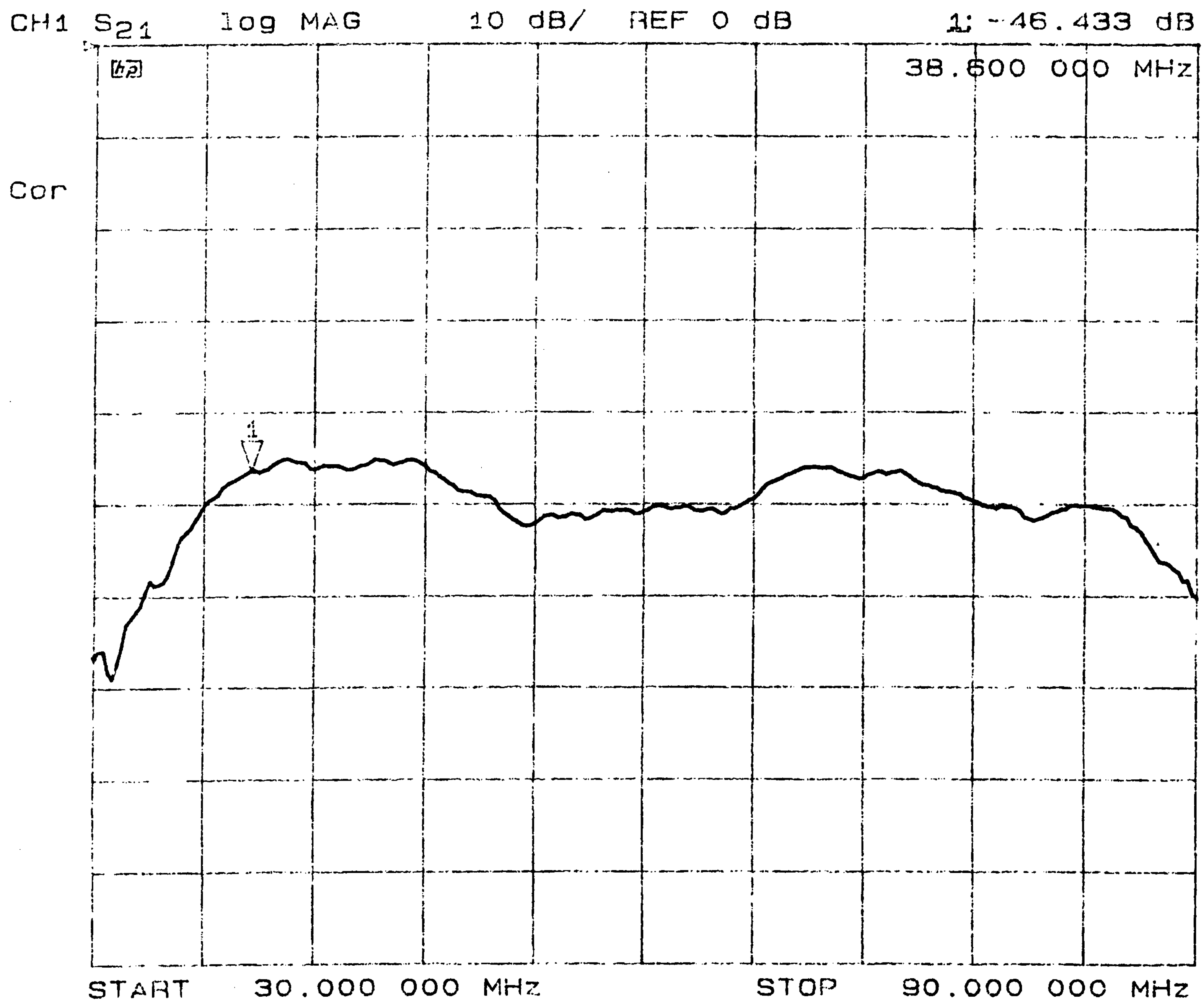


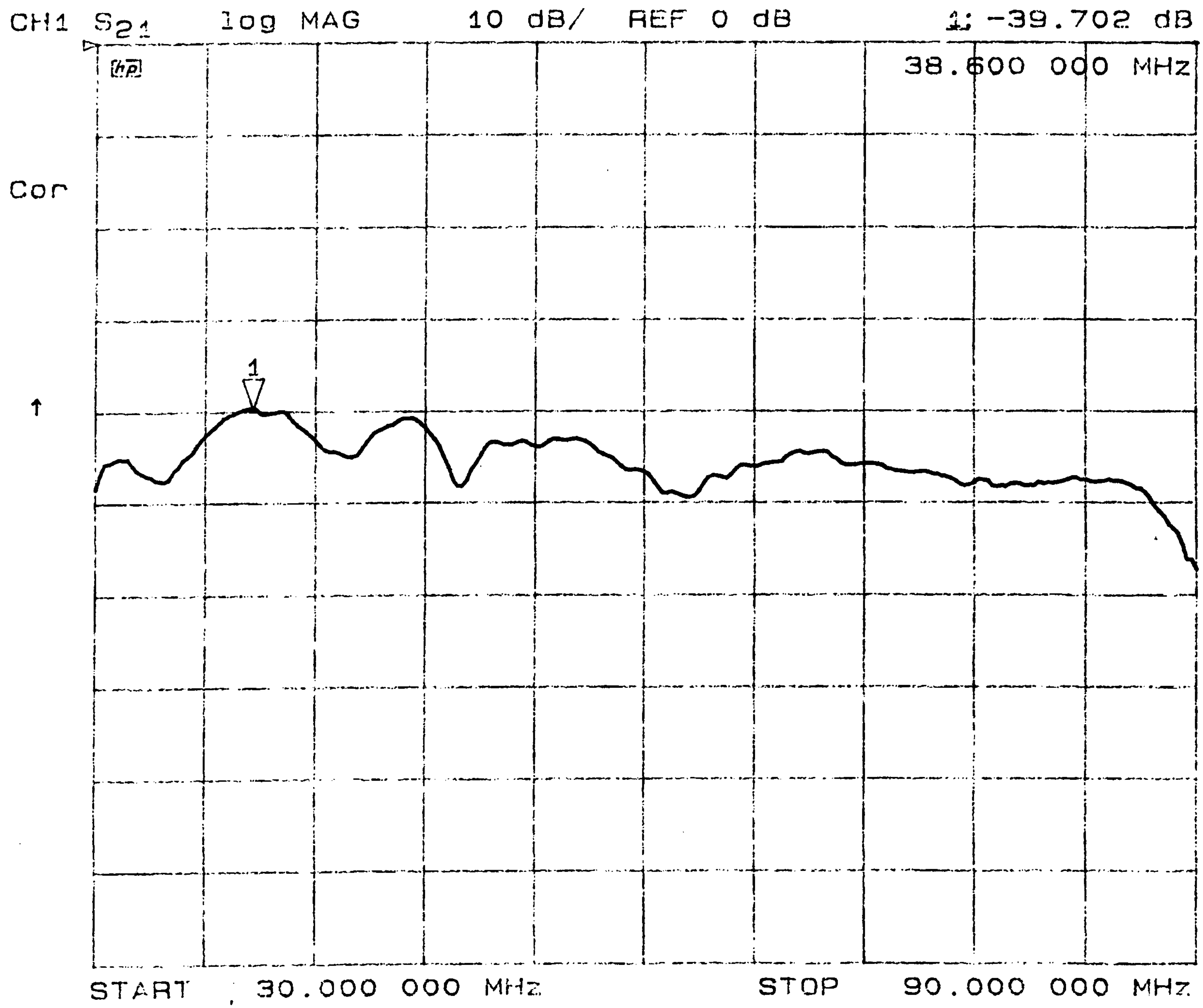
START 30.00MHz STOP 90.00MHz
*RBW 30kHz VBW 30kHz SWP 200ms



CH1 S21 log MAG 10 dB/ REF 0 dB 1: -46.248 dB
32.000 000 MHz
Cor
1
START 30.000 000 MHz STOP 90.000 000 MHz

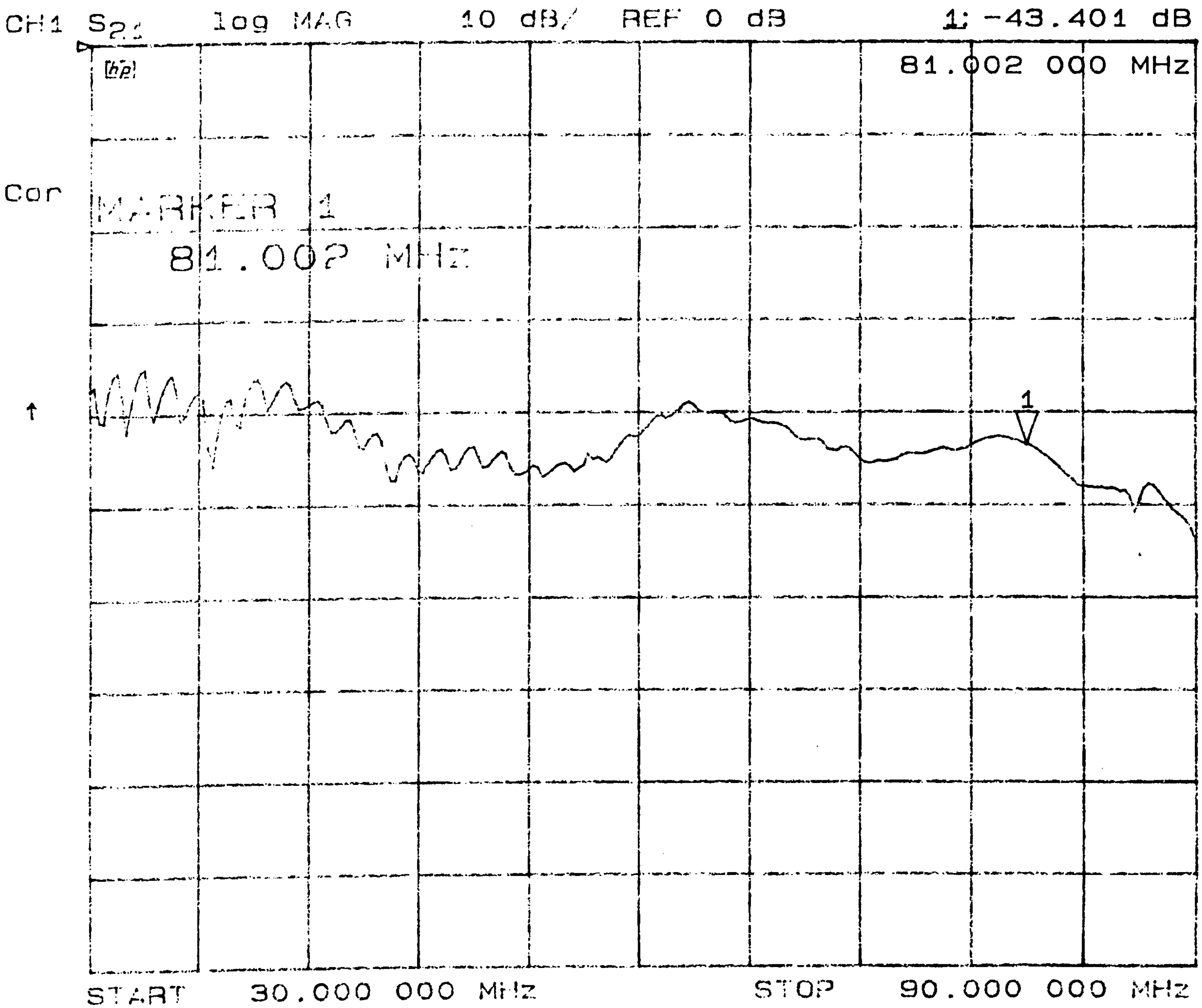
100 FT


CH1 S21 log MAG 10 dB/ REF 0 dB 1: -46.433 dB
38.600 000 MHz
Cor
1
START 30.000 000 MHz
STOP 90.000 000 MHz



CH1 S21 log MAG 10 dB/ REF 0 dB 1: -39.702 dB
38.600 000 MHz
Cor
1
START 30.000 000 MHz
STOP 90.000 000 MHz

50FT


CH1 S21 log MAG 10 dB/ REF 0 dB 1: -43.401 dB
81.002 000 MHz
Cor
MARKER 1
81.002 MHz
1
START 30.000 000 MHz STOP 90.000 000 MHz

APPENDIX E

AN/ARQ-53 Eglin Flight Test of 12 March 1996

AN/ARQ-53

Shipboard SINCGARS Relay System

Test Report

Eglin Flight Test
(9/25/95 - 9/28/95)

12 March 1996

Prepared for:
Space and Naval Warfare Systems Command
PMW 176-3G
Arlington, VA 22245

Prepared by:
Naval Air Warfare Center Aircraft Division
SINCGARS Team, Code 11X337C61
Indianapolis, IN 46219

Keith A. Williams
Keith A. Williams,
Team Leader

Warren W. Glen.
Warren W. Glen.,
Electrical Engineer

1. INTRODUCTION

This report documents the flight tests conducted at Eglin Air Force Base of the Radio Repeater Set, AN/ARQ-53, commonly known as the Relay, for the US Navy Shipboard SINCGARS program. This test was conducted at Eglin Air Force Base FL. Aircraft and facilities were provided by Eglin Air Force base with additional test equipment provided by NAWCAD Indianapolis.

1.1 Purpose of the Test

The purpose of this test was to provide functional performance data of the AN/ARQ-53 Relay during an actual flight scenario at various ranges and aircraft orientations at a BER (Bit Error Rate) of 4.8 KBPS. An additional purpose was to gather rough maximum range information various antenna profiles. This test was performed in support of SPAWAR Statement of Work PMW 172-11D-062-95. This report is prepared in accordance with CDRL T006 and DID DI-NDTI-80604.

1.2 Item Tested

Nomenclature	Radio Repeater Set, AN/ARQ-53
Model or Part Number	91E2N100
Type of Test Item	Engineering Development Model
Serial Number	X003
Applicable Engineering Changes	AC/DC Model
Developmental Specification	SPAWAR-S-839
Date of Manufacture	May 1994

1.3 Test Requirements

The test was intended to determine if the relay will meet the range/performance requirements using a data rate of 4.8 KBPS. Minimum range requirements are 35 n-mile ship to relay, 15 n-mile shore to relay. Goal range requirements are 50 n-mile ship to relay, 25 n-mile shore to relay.

2. SUMMARY

This test consisted of five flights of the Radio Repeater Set, AN/ARQ-53, more commonly known as the Shipboard SINCGARS Relay System. Time and position information recorded by radar was provided on disk by Eglin.

There were four locations used in the gathering of information during these flights.

a) A15. This site was used as the base site to simulate the shipboard system.
b) A3 This site was approximately 12 n-miles east of A15
c) D1A This site was approximately 30 n-miles east of A15
d) D1B This site was approximately 55 n-miles east of A15

All flights were conducted over the Gulf of Mexico with the aircraft at an altitude of approximately 3000 ft.

Information was gathered at 4.8 KBPS and 16 KBPS with the relay receive antenna mounted both in the upright and the downward locations.

3. REFERENCES

SPAWAR-S-836 15 August 1990	Shipboard Single Channel Ground and Airborne Radio System (SINCGARS) System Specification
SPAWAR-S-839	Shipboard Single Channel Ground and Airborne

25 March 1991	Radio System (SINCGARS) Relay Segment Specification
31 October 1994	Test Support Plan, Shipboard Single Channel Ground and Airborne Relay System

4. REPORT

4.1 Test Equipment Identification

a) Base Station (Communications Van Located at A15)

Two RT-1523(c)/VRCs (SN 041869A, #22; SN 041792A #21)

One Vehicular Mount Amp AM-7238/VRC (SN 64010918)

One Vehicular Mount Adapter AM7239/VRC (SN62014554)

One VHF radio for communication with Remote Site and CCF (Command Control Facility

One UHF radio for communication with Remote Site and CCF

One cellular phone for communication with Remote Site and CCF

One AN/ARQ-53 Test Set Interface Unit

One Firebird MC6000 Communications Analyzer S/N 16113

Two AS-3900 Antennas

Two DCTs (Digital Communications Terminal)

One DCT Power Supply

One Spectrum Analyzer

b) Remote Station (Communications Van Located at A3, D1A, or D1B)

Two RT-1523(c)/VRCs (SN 041879A #24, SN041864A #23)

One Vehicular Mount Amp AM-7238/VRC (SN 64010819)

One Vehicular Mount Adapter AM7239/VRC

One VHF radio for communication with Remote Site and CCF (Command Control Facility

One UHF radio for communication with Remote Site and CCF

One AN/ARQ-53 Test Set Interface Unit

One HP N645A Data Error Analyzer S/N 2734A05169

One AS-3900 Antennas and One AS-3864 Antenna

Two DCTs (Digital Communications Terminal)

4.2 Test facility installation and set-up

a) Frequencies used during this test were as follows:

1) FH1	F100
2) FH2	F200
3) FH3	F300
4) FH4	F350

b) Radios were loaded with the following presets

1) AN/ARQ-53

RT1	FH1

RT2	FH2
RT3	FH3
RT4	FH4

Note: During testing channel one (RT1 and RT2 were used)

2) Base Station and Remote Stations
RT1523s FH1, FH2, FH3, FH4

c) At the base site the antenna used for data testing was located at approximately one hundred foot on a communications tower. An additional antenna used to sample the environment was located on a 60 ft mast mounted on the communications van.

d) At the remote sites the AS-3864 antenna used for data testing was located on a 20 ft mast mounted on the communications van. A manpack antenna was also used on some of the data links.

e) During the flight Eglin provided a CCF (Command Control Facility) with real time radar tracking. This facility was used to control both the position of the aircraft and the remote site data gathering.

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4.3 Test Procedures

4.3.1 Flight 1

During this flight the base station was located at A15 and the remote site was located at A3. The relay was installed to the UH-1N using the antenna configuration with both the receive and transmit antennas oriented in the upward position. The main purpose of this flight was to simulate and test the link between the shore and relay using the up antenna configuration. This was done by keeping the range between A15 and the relay to a minimum while varying the range between A3 and the relay between 5 and 25 n-miles in 5 n-mile increments. During the flights the aircraft was flying a pattern perpendicular to A3 to simulate the mission scenario with the aircraft between the ship and shore. Data was transmitted through the relay between A15 and A3 using both a manpack antenna and a vehicular antenna located at A3. BER performance information was recorded at both sites. All tests were conducted at 4 watts output power during this flight.

4.3.2 Flight 2

During this flight the base station was located at A15 and the remote site was located at D1A. The relay was installed to the UH-1N using the antenna configuration with both the receive and transmit antennas oriented in the upward position. The main purpose of this flight was to simulate and test the link between the ship and relay using the up antenna configuration. This was done by keeping the range between D1A and the relay to a minimum while varying the range between A15 and the relay between 25 and 45 n-miles in 5 n-mile increments. During the flights the aircraft was flying a pattern perpendicular to A15 to simulate the mission scenario with the aircraft between the ship and shore. Additional patterns were flown with a range of 40 n-miles from A15 with the aircraft flying in 45 degree heading increments. Data was transmitted through the relay between A15 and D1A using vehicular antennas located at both sites . BER performance information was recorded at both sites. All tests were conducted at 4 watts output power during this flight.

4.3.3 Flight 3

During this flight the base station was located at A15 and the remote site was located at D1A. The relay was installed to the UH-1N using the antenna configuration with the receive antenna rotated downward and the transmit antenna oriented in the upward position. The main purpose of this flight was to simulate and test the link between the ship and relay using the receive antenna down configuration. This was done by keeping the range between D1A and the relay to a minimum while varying the range between A15 and the relay between 25 and 45 n-miles in 5 n-mile increments. During the flights the aircraft was flying a pattern perpendicular to A15 to simulate the mission scenario with the aircraft between the ship and shore. Additional patterns were flown with a range of 40 n-miles from A15 with the aircraft flying in 45 degree heading increments. Data was transmitted through the relay between A15 and D1A using vehicular antennas located at both sites . BER performance information was recorded at both sites. All tests were conducted at both 4 and 50 watt output power during this flight.

4.3.4 Flight 4

During this flight the base station was located at A15 and the remote site was located at A3. The relay was installed to the UH-1N using the antenna configuration with the receive antenna rotated downward and the transmit antenna oriented in the upward position. The main purpose of this flight was to determine DCT and BER performance at various headings using the receive antenna down configuration. This was done by flying with an approximate range of 20 n-miles from A15 and 25 n-miles from A3 with the aircraft flying in 45 degree heading increments. Additional range performance using the manpack antenna at A3 was performed by flying inbound to 5 n-mile. Data was transmitted through the relay between A15 and A3 using both a manpack antenna and a vehicular antenna located at A3. DCT and BER performance information was recorded at both sites. All tests were conducted at both 4 and 50 watts output power during this flight.

4.3.5 Flight 5

During this flight the base station was located at A15 and the remote site was located at D1B. The relay was installed to the UH-1N using the antenna configuration with the receive antenna rotated downward and the transmit antenna oriented in the upward position. The main purpose of this flight was to determine DCT and BER performance at maximum ranges with an inline link scenario using the receive antenna down configuration. This was done by flying between A15 and D1B with an initial range of 25 n-miles between each site. The range was then increased from A15 up to a maximum range of 50 n-miles. The distance between the aircraft and D1B was varied between 15 and 25 n-miles during this flight. Data was transmitted through the relay between A15 and D1B using vehicular antennas located at A15 and D1B. DCT and BER performance information was recorded at both sites. All tests were conducted at both 4 and 50 watts output power during this flight.

4.4 Test Results and Analysis

4.4.1 Recorded Data

The following tables depict the data gathered during this flight:

TABLE 1: Flight 1

Date	Aircraft Config	Range A15	Range A3	Range D1A	Range D1B	Aircraft Heading	Antenna	Data Rate (KBPS)	Time	BER A15	BER A3	BER D1A	BER D1B	SND A3	SND A15	MSG RCV	RPL RCV	NOTES
9/21/95	Both Up	10	5			135	MP4-V	16	21:48:00	NS								
9/21/95	Both Up	10	5			135	MP4-V	16	21:49:00	NS								
9/21/95	Both Up	10	5			315	MP4-V	16	21:52:00	RT								
9/21/95	Both Up	10	5			315	MP4-V	16	21:53:00	RT								
9/21/95	Both Up	10	5			135	MP4-V	4.8	21:55:28	RT								
9/21/95	Both Up	10	5			135	MP4-V	4.8	21:56:42	17.0%								
9/21/95	Both Up	10	5			135	MP4-V	4.8	21:58:20	10.7%								
9/21/95	Both Up	10	5			315	MP4-V	4.8	22:00:50	9.36%								
9/21/95	Both Up	10	5			315	MP4-V	4.8	22:01:50	7.00%								
9/21/95	Both Up	10	5			315	MP4-V	4.8	22:02:33	9.00%								
9/21/95	Both Up	10	5			315	V4-V	4.8	22:08:42	NS								
9/21/95	Both Up	10	5			315	V4-V	4.8	22:09:14	0.02%								
9/21/95	Both Up	10	5			315	V4-V	4.8	22:09:50	0.01%								
9/21/95	Both Up	10	5			135	V4-V	4.8	22:11:35	0.18%								
9/21/95	Both Up	10	5			135	V4-V	4.8	22:12:21	0.02%								
9/21/95	Both Up	10	5			135	V4-V	4.8	22:13:25	0.30%								
9/21/95	Both Up	10	5			135	V4-V	4.8	22:13:51	0.60%								
9/21/95	Both Up	10	5			135	V4-V	4.8	22:14:20	0.90%								
9/21/95	Both Up	10	5			315	V4-V	4.8	22:15:46	NS								
9/21/95	Both Up	10	5			315	V4-V	4.8	22:16:56	NS								
9/21/95	Both Up	10	5			315	V4-V	4.8	22:21:48	RT								
9/21/95	Both Up	10	10			135	V4-V	4.8	22:22:33	0.30%								
9/21/95	Both Up	10	10			135	V4-V	4.8	22:22:33	0.20%								
9/21/95	Both Up	10	10			315	V4-V	4.8	22:24:01	0.20%								
9/21/95	Both Up	10	10			315	V4-V	4.8	22:24:42	NS								
9/21/95	Both Up	10	10			315	V4-V	4.8	22:25:06	0.40%								

TABLE 1: Flight 1

Date	Aircraft Config	Range A15	Range A3	Range D1A	Range D1B	Aircraft Heading	Antenna	Data Rate (KBPS)	Time	BER A15	BER A3	BER D1A	BER D1B	SND A3	SND A15	MSG RCV	RPL RCV	NOTES
9/21/95	Both Up	12	15			135	V4-V	4.8	22:41:24	NS								
9/21/95	Both Up	12	15			135	V4-V	4.8	22:41:46	NS								
9/21/95	Both Up	12	15			135	V4-V	4.8	22:42:08	0.20%								
9/21/95	Both Up	12	15			135	V4-V	4.8	22:42:45	0.20%								
9/21/95	Both Up	12	15			315	V4-V	4.8	22:45:10	0.20%								
9/21/95	Both Up	12	15			315	V4-V	4.8	22:45:50	0.30%								
9/21/95	Both Up	15	20			135	V4-V	4.8	22:51:54	0.20%								
9/21/95	Both Up	15	20			135	V4-V	4.8	22:52:50	0.22%								
9/21/95	Both Up	15	20			135	V4-V	4.8	22:53:25	0.18%								
9/21/95	Both Up	15	20			315	V4-V	4.8	22:54:49	0.56%								
9/21/95	Both Up	15	20			315	V4-V	4.8	22:55:34	0.40%								
9/21/95	Both Up	22	25			315	V4-V	4.8	23:11:25	0.43%								
9/21/95	Both Up	22	25			315	V4-V	4.8	23:11:58	0.46%								
9/21/95	Both Up	22	25			135	V4-V	4.8	23:13:35	0.32%								
9/21/95	Both Up	22	25			135	V4-V	4.8	23:14:12	0.49%								
9/21/95	Both Up	20	18			360	V4-V	16	23:18:45	6.92%								
9/21/95	Both Up	20	18			360	V4-V	16	23:18:58	6.58%								
9/21/95	Both Up	20	18			180	V4-V	16	23:21:10	NS								
9/21/95	Both Up	20	18			180	V4-V	16	23:21:25	12.4%								
9/21/95	Both Up	20	18			180	V4-V	16	23:21:43	10.9%								
9/21/95	Both Up	20	18			180	V4-V	4.8	23:22:00	3.30%								
9/21/95	Both Up	20	19			90	V4-V	16	23:22:00	2.86%								
9/21/95	Both Up	20	19			90	V4-V	16	23:23:56	2.21%								
9/21/95	Both Up	20	19			90	V4-V	4.8	23:24:23	0.17%								
9/21/95	Both Up	20	19			90	V4-V	4.8	23:24:57	0.05%								
9/21/95	Both Up	20	19.5			270	V4-V	16	23:26:12	7.69%								
9/21/95	Both Up	20	19.5			270	V4-V	16	23:26:41	NS								
9/21/95	Both Up	20	19.5			370	V4-V	4.8	23:27:10	1.44%								
9/21/95	Both Up	20	19.5			270	V4-V	4.8	23:27:46	0.41%								
9/21/95	Both Up	10	5			135	V4-MP	16	21:31:10		34.0%							
9/21/95	Both Up	10	5			135	V4-MP	16	xxxx		0.58%							
9/21/95	Both Up	10	5			135	V4-MP	16	xxxx		0.80%							

TABLE 1: Flight 1

Date	Aircraft Config	Range A15	Range A3	Range D1A	Range D1B	Aircraft Heading	Antenna	Data Rate (KBPS)	Time	BER A15	BER A3	BER D1A	BER D1B	SND A3	SND A15	MSG RCV	RPL RCV	NOTES
9/21/95	Both Up	10	5			135	V4-MP	16	21:39:19		0.41%							
9/21/95	Both Up	10	5			135	V4-MP	16	21:39:41		0.54%							
9/21/95	Both Up	10	5			135	V4-MP	16	21:39:58		0.45%							
9/21/95	Both Up	10	5			135	V4-MP	16	21:40:21		0.64%							
9/21/95	Both Up	10	5			315	V4-MP	16	21:43:08		0.34%							
9/21/95	Both Up	10	5			315	V4-MP	16	21:43:10		0.41%							
9/21/95	Both Up	10	5			315	V4-MP	16	21:43:38		0.35%							
9/21/95	Both Up	10	5			315	V4-MP	16	21:44:09		0.59%							
9/21/95	Both Up	10	5			315	V4-MP	16	21:44:51		0.83%							
9/21/95	Both Up	10	5			315	V4-MP	16	21:45:05		0.74%							
9/21/95	Both Up	10	10			135	V4-V	4.8	22:27:21		0.48%							
9/21/95	Both Up	10	10			135	V4-V	4.8	22:28:09		0.46%							
9/21/95	Both Up	10	10			135	V4-V	4.8	22:28:47		0.46%							
9/21/95	Both Up	10	10			315	V4-V	4.8	22:30:40		0.44%							
9/21/95	Both Up	10	10			315	V4-V	4.8	22:31:22		0.47%							
9/21/95	Both Up	12	15			135	V4-V	4.8	22:36:27		0.46%							
9/21/95	Both Up	12	15			135	V4-V	4.8	22:37:35		0.41%							
9/21/95	Both Up	12	15			315	V4-V	4.8	22:39:01		0.42%							
9/21/95	Both Up	12	15			315	V4-V	4.8	22:39:52		0.49%							
9/21/95	Both Up	15	20			315	V4-V	4.8	22:57:01		0.47%							
9/21/95	Both Up	15	20			135	V4-V	4.8	22:58:54		0.47%							
9/21/95	Both Up	15	20			135	V4-V	4.8	23:00:23		0.48%							
9/21/95	Both Up	15	20			315	V4-V	4.8	23:01:49		0.49%							
9/21/95	Both Up	22	25			135	V4-V	4.8	23:07:00		0.47%							
9/21/95	Both Up	22	25			135	V4-V	4.8	22:08:17		0.47%							
9/21/95	Both Up	22	25			315	V4-V	4.8	23:10:08		0.51%							
9/21/95	Both Up	22	25			315	V4-V	4.8	23:10:56		0.55%							

TABLE 2: Flight 2

Date	Aircraft Config	Range A15	Range A3	Range D1A	Range D1B	Aircraft Heading	Antenna	Data Rate (KBPS)	Time	BER A15	BER A3	BER D1A	BER D1B	SND A3	SND A15	MSG RCV	RPL RCV	NOTES
9/22/95	Both Up	25		12		20	V4-V	16	19:36:06	NS								
9/22/95	Both Up	25		12		20	V4-V	16	19:36:56	NS								
9/22/95	Both Up	25		12		20	V4-V	16	19:37:30	NS								
9/22/95	Both Up	25		12		20	V4-V	16	19:38:14	NS								
9/22/95	Both Up	25		12		220	V4-V	16	19:40:10	0.86%								
9/22/95	Both Up	25		12		220	V4-V	16	19:40:38	NS								
9/22/95	Both Up	25		12		220	V4-V	16	19:41:15	NS								
9/22/95	Both Up	25		12		220	V4-V	4.8	19:42:00	0.11%								
9/22/95	Both Up	25		12		220	V4-V	4.8	19:42:47	0.96%								
9/22/95	Both Up	25		12		20	V4-V	4.8	19:44:55	1.40%								
9/22/95	Both Up	25		12		20	V4-V	4.8	19:45:40	1.08%								
9/22/95	Both Up	25		12		20	V4-V	4.8	19:46:46	1.05%								
9/22/95	Both Up	25		12		20	V4-V	4.8	19:47:59	0.38%								LAND
9/22/95	Both Up	25		12		220	V4-V	4.8	19:50:25	0.21%								LAND
9/22/95	Both Up	25		12		220	V4-V	4.8	19:51:18	0.41%								
9/22/95	Both Up	25		12		220	V4-V	4.8	19:52:27	1.12%								
9/22/95	Both Up	25		12		220	V4-V	4.8	19:53:07	0.70%								
9/22/95	Both Up	30		7		20	V4-V	4.8	19:58:44	0.34%								
9/22/95	Both Up	30		7		20	V4-V	4.8	19:59:28	0.52%								
9/22/95	Both Up	30		7		20	V4-V	4.8	20:00:34	0.71%								
9/22/95	Both Up	30		7		20	V4-V	4.8	20:01:42	1.38%								P LAND
9/22/95	Both Up	30		7		20	V4-V	4.8	20:02:34	0.33%								LAND
9/22/95	Both Up	30		7		220	V4-V	4.8	20:04:01	0.75%								WATER
9/22/95	Both Up	30		7		220	V4-V	4.8	20:04:45	0.40%								
9/22/95	Both Up	30		7		220	V4-V	4.8	20:05:23	0.95%								
9/22/95	Both Up	35		2		20	V4-V	4.8	20:23:31	0.53%								
9/22/95	Both Up	35		2		20	V4-V	4.8	20:24:32	1.23%								
9/22/95	Both Up	35		2		220	V4-V	4.8	20:25:58	1.06%								
9/22/95	Both Up	35		2		220	V4-V	4.8	20:26:55	1.13%								
9/22/95	Both Up	35		2		220	V4-V	4.8	20:27:38	1.15%								
9/22/95	Both Up	35		2		220	V4-V	4.8	20:28:22	1.01%								
9/22/95	Both Up	35		2		20	V4-V	4.8	20:30:40	0.94%								

TABLE 2: Flight 2

Date	Aircraft Config	Range A15	Range A3	Range D1A	Range D1B	Aircraft Heading	Antenna	Data Rate (KBPS)	Time	BER A15	BER A3	BER D1A	BER D1B	SND A3	SND A15	MSG RCV	RPL RCV	NOTES
9/22/95	Both Up	35		2		20	V4-V	4.8	20:31:27	1.05%								
9/22/95	Both Up	40		7		20	V4-V	4.8	20:36:40	1.00%								
9/22/95	Both Up	40		7		20	V4-V	4.8	20:37:37	0.56%								
9/22/95	Both Up	40		7		20	V4-V	4.8	20:38:10	0.81%								
9/22/95	Both Up	40		7		220	V4-V	4.8	20:39:43	0.23%								LAND
9/22/95	Both Up	40		7		220	V4-V	4.8	20:40:21	1.39%								
9/22/95	Both Up	40		7		220	V4-V	4.8	20:41:02	1.67%								
9/22/95	Both Up	40		7		220	V4-V	4.8	20:41:58	0.88%								
9/22/95	Both Up	45		15		20	V4-V	4.8	21:05:52	NS								
9/22/95	Both Up	45		15		20	V4-V	4.8	21:06:22	0.98%								
9/22/95	Both Up	45		15		20	V4-V	4.8	21:07:12	2.71%								LAND
9/22/95	Both Up	45		15		20	V4-V	4.8	21:07:57	1.34%								
9/22/95	Both Up	45		15		220	V4-V	4.8	21:10:02	NS								
9/22/95	Both Up	45		15		220	V4-V	4.8	21:10:40	0.72%								
9/22/95	Both Up	45		15		220	V4-V	4.8	21:11:11	1.54%								
9/22/95	Both Up	45		15		220	V4-V	4.8	21:11:58	1.34%								
9/22/95	Both Up	45		15		45	V4-V	4.8	21:17:25			0.51%						CC
9/22/95	Both Up	45		15		45	V4-V	4.8	21:17:58			0.53%						CC
9/22/95	Both Up	45		15		315	V4-V	4.8	21:20:05			0.01%						CC
9/22/95	Both Up	45		15		315	V4-V	4.8	21:20:46			0.01%						CC
9/22/95	Both Up	45		15		225	V4-V	4.8 CT	21:22:21			0.81%						CC
9/22/95	Both Up	45		15		225	V4-V	4.8	21:23:06			NS						CC
9/22/95	Both Up	45		15		225	V4-V	4.8	21:23:30			1.19%						CC
9/22/95	Both Up	45		15		225	V4-V	4.8	21:24:32			1.12%						CC
9/22/95	Both Up	45		15		135	V4-V	4.8	21:25:59			NS						CC
9/22/95	Both Up	45		15		135	V4-V	4.8	21:26:37			NS						CC
9/22/95	Both Up	45		15		135	V4-V	4.8	21:26:57			2.17%						CC
9/22/95	Both Up	25		12		20	V4-V	16	19:29:27			0.99%						
9/22/95	Both Up	25		12		200	V4-V	16	19:32:20			0.98%						
9/22/95	Both Up	25		12		200	V4-V	16	19:33:01			1.08%						
9/22/95	Both Up	25		12		20	V4-V	16	19:35:22			1.24%						
9/22/95	Both Up	30		7		200	V4-V	4.8	20:06:37			0.56%						
9/22/95	Both Up	30		7		200	V4-V	4.8	20:07:22			0.55%						

TABLE 2: Flight 2

Date	Aircraft Config	Range A15	Range A3	Range D1A	Range D1B	Aircraft Heading	Antenna	Data Rate (KBPS)	Time	BER A15	BER A3	BER D1A	BER D1B	SND A3	SND A15	MSG RCV	RPL RCV	NOTES
9/22/95	Both Up	30		7		200	V4-V	4.8	20:07:58			0.58%						
9/22/95	Both Up	30		7		20	V4-V	4.8	20:09:50			0.47%						
9/22/95	Both Up	30		7		20	V4-V	4.8	20:10:30			0.45%						
9/22/95	Both Up	30		7		20	V4-V	4.8	20:11:00			0.46%						
9/22/95	Both Up	35		2		200	V4-V	4.8	20:16:40			0.74%						
9/22/95	Both Up	35		2		200	V4-V	4.8	20:18:01			0.57%						
9/22/95	Both Up	35		2		200	V4-V	4.8	20:18:42			0.69%						
9/22/95	Both Up	35		2		20	V4-V	4.8	20:20:30			0.46%						
9/22/95	Both Up	35		2		20	V4-V	4.8	20:21:00			0.46%						
9/22/95	Both Up	35		2		20	V4-V	4.8	20:21:50			0.45%						
9/22/95	Both Up	40		7		200	V4-V	4.8	20:43:02			0.83%						
9/22/95	Both Up	40		7		200	V4-V	4.8	20:44:00			0.83%						
9/22/95	Both Up	40		7		200	V4-V	4.8	20:44:45			0.98%						
9/22/95	Both Up	40		7		20	V4-V	4.8	20:46:52			0.46%						
9/22/95	Both Up	40		7		20	V4-V	4.8	20:47:33			0.47%						
9/22/95	Both Up	40		7		20	V4-V	4.8	20:48:09			0.47%						
9/22/95	Both Up	40		7		20	V4-V	4.8	20:49:17			0.48%						
9/22/95	Both Up	40		7		20	V4-V	4.8	20:51:26			0.74%						
9/22/95	Both Up	40		7		200	V4-V	4.8	20:53:55			0.70%						
9/22/95	Both Up	45		15		200	V4-V	4.8	20:58:34			1.09%						
9/22/95	Both Up	45		15		200	V4-V	4.8	20:59:29			1.19%						
9/22/95	Both Up	45		15		200	V4-V	4.8	21:00:12			1.04%						
9/22/95	Both Up	45		15		200	V4-V	4.8	21:01:21			1.21%						
9/22/95	Both Up	45		15		20	V4-V	4.8	21:03:39			0.52%						
9/22/95	Both Up	45		15		20	V4-V	4.8	21:04:20			0.54%						
9/22/95	Both Up	45		15		20	V4-V	4.8	21:04:54			0.55%						
9/22/95	Both Up	45		15		45	V4-V	4.8	21:17:21			0.51%						
9/22/95	Both Up	45		15		45	V4-V	4.8	21:17:55			0.53%						
9/22/95	Both Up	45		15		315	V4-V	4.8	21:20:12			0.55%						
9/22/95	Both Up	45		15		315	V4-V	4.8	21:20:46			0.52%						
9/22/95	Both Up	45		15		315	V4-V	4.8 CT	21:21:40			1.08%						TURN
9/22/95	Both Up	45		15		225	V4-V	4.8 CT	21:22:32			0.81%						
9/22/95	Both Up	45		15		225	V4-V	4.8	21:23:27			1.19%						
9/22/95	Both Up	45		15		225	V4-V	4.8	21:24:49			1.18%						
9/22/95	Both Up	45		15		135	V4-V	4.8	21:27:06			2.17%						

TABLE 3: Flight 3

Date	Aircraft Config	Range A15	Range A3	Range D1A	Range D1B	Aircraft Heading	Antenna	Data Rate (KBPS)	Time	BER A15	BER A3	BER D1A	BER D1B	SND A3	SND A15	MSG RCV	RPL RCV	NOTES
9/25/95	Rcv Down	25		12		200	V50-V	4.8	15:22:24	OE								OP ERR
9/25/95	Rcv Down	25		12		200	V50-V	4.8	15:23:18	0.83%								
9/25/95	Rcv Down	25		12		200	V50-V	4.8	15:24:05	0.24%								
9/25/95	Rcv Down	25		12		200	V50-V	4.8	15:24:43	0.36%								
9/25/95	Rcv Down	25		12		20	V50-V	4.8	15:26:25	0.21%								
9/25/95	Rcv Down	25		12		20	V50-V	4.8	15:26:58	0.14%								
9/25/95	Rcv Down	25		12		20	V50-V	4.8	15:27:37	0.18%								
9/25/95	Rcv Down	30		7		200	V50-V	4.8	15:48:25	0.06%								
9/25/95	Rcv Down	30		7		200	V50-V	4.8	15:49:01	0.49%								
9/25/95	Rcv Down	30		7		200	V50-V	4.8	15:49:37	0.66%								
9/25/95	Rcv Down	30		7		200	V4-V	4.8	15:50:26	0.15%								
9/25/95	Rcv Down	30		7		200	V4-V	4.8	15:51:02	0.72%								
9/25/95	Rcv Down	30		7		20	V4-V	4.8	15:52:41	0.13%								
9/25/95	Rcv Down	30		7		20	V4-V	4.8	15:53:14	0.97%								
9/25/95	Rcv Down	35		2		200	V4-V	16	15:58:13	2.84%								
9/25/95	Rcv Down	35		2		200	V4-V	16	15:58:50	3.64%								
9/25/95	Rcv Down	35		2		200	V4-V	4.8	15:59:14	0.24%								
9/25/95	Rcv Down	35		2		200	V4-V	4.8	15:59:54	0.29%								
9/25/95	Rcv Down	35		2		20	V4-V	16	16:01:38	3.04%								
9/25/95	Rcv Down	35		2		20	V4-V	16	16:02:01	3.62%								
9/25/95	Rcv Down	35		2		20	V4-V	4.8	16:02:36	0.36%								
9/25/95	Rcv Down	35		2		20	V4-V	4.8	16:03:16	0.57%								
9/25/95	Rcv Down	40		7		20	V4-V	4.8	16:20:15	1.33%								LAND
9/25/95	Rcv Down	40		7		200	V4-V	4.8	16:21:35	0.28%								LAND
9/25/95	Rcv Down	40		7		200	V4-V	4.8	16:22:10	0.24%								LAND
9/25/95	Rcv Down	40		7		200	V4-V	4.8	16:22:56	0.29%								L&W
9/25/95	Rcv Down	40		7		200	V4-V	4.8	16:24:48	0.50%								
9/25/95	Rcv Down	40		7		200	V4-V	4.8	16:25:05	0.24%								
9/25/95	Rcv Down	40		7		200	V4-V	4.8	16:25:36	0.24%								
9/25/95	Rcv Down	40		7		20	V4-V	4.8	16:27:09	0.22%								
9/25/95	Rcv Down	40		7		20	V4-V	4.8	16:28:06	0.32%								
9/25/95	Rcv Down	45		15		200	V4-V	4.8	16:45:02	0.83%								

TABLE 3: Flight 3

Date	Aircraft Config	Range A15	Range A3	Range D1A	Range D1B	Aircraft Heading	Antenna	Data Rate (KBPS)	Time	BER A15	BER A3	BER D1A	BER D1B	SND A3	SND A15	MSG RCV	RPL RCV	NOTES
9/25/95	Rcv Down	45		15		200	V4-V	4.8	16:45:03	0.89%								
9/25/95	Rcv Down	45		15		200	V4-V	4.8	16:46:02	0.91%								
9/25/95	Rcv Down	45		15		20	V4-V	4.8	16:47:40	1.47%								
9/25/95	Rcv Down	45		15		20	V4-V	4.8	16:48:17	1.82%								
9/25/95	Rcv Down	45		15		20	V4-V	4.8 CT	16:49:00	1.73%								
9/25/95	Rcv Down	45		15		85	V4-V	4.8	16:31:45									ND
9/25/95	Rcv Down	45		15		85	V4-V	4.8	16:32:13									ND
9/25/95	Rcv Down	45		15		180	V4-V	4.8	16:53:10			0.70%						
9/25/95	Rcv Down	45		15		180	V4-V	4.8	16:53:30			0.52%						
9/25/95	Rcv Down	45		15		180	V4-V	4.8 CT	16:53:52			0.28%						
9/25/95	Rcv Down	45		15		270	V4-V	4.8	16:55:13			0.69%						
9/25/95	Rcv Down	45		15		270	V4-V	4.8	16:55:45			0.58%						
9/25/95	Rcv Down	45		15		270	V4-V	4.8 CT	16:56:30			0.38%						
9/25/95	Rcv Down	45		15		90	V4-V	4.8	16:58:04			NR						
9/25/95	Rcv Down	45		15		90	V4-V	4.8	16:58:24			0.46%						
9/25/95	Rcv Down	45		15		90	V4-V	4.8	16:59:03			0.57%						
9/25/95	Rcv Down	45		15		90	V4-V	4.8 CT	16:59:41			0.33%						
9/25/95	Rcv Down	45		15		0	V4-V	4.8	17:00:50			0.49%						
9/25/95	Rcv Down	45		15		0	V4-V	4.8	17:01:21			0.49%						
9/25/95	Rcv Down	45		15		0	V4-V	4.8 CT	17:01:59			0.22%						
9/25/95	Rcv Down	45		15		225	V4-V	4.8	17:04:02			0.67%						
9/25/95	Rcv Down	45		15		225	V4-V	4.8	17:04:52			NR						
9/25/95	Rcv Down	45		15		225	V4-V	4.8	17:05:18			0.69%						
9/25/95	Rcv Down	45		15		225	V4-V	4.8 CT	17:06:02			0.49%						
9/25/95	Rcv Down	45		15		135	V4-V	4.8	17:07:43			0.50%						
9/25/95	Rcv Down	45		15		135	V4-V	4.8	17:08:37			0.70%						
9/25/95	Rcv Down	45		15		135	V4-V	4.8 CT	17:09:03			0.26%						
9/25/95	Rcv Down	45		15		45	V4-V	4.8	17:10:18			0.47%						
9/25/95	Rcv Down	45		15		45	V4-V	4.8	17:10:50			0.65%						
9/25/95	Rcv Down	45		15		45	V4-V	4.8 CT	17:11:26			0.40%						
9/25/95	Rcv Down	45		15		315	V4-V	4.8	17:12:29			NR						
9/25/95	Rcv Down	45		15		315	V4-V	4.8	17:12:45			0.67%						
9/25/95	Rcv Down	45		15		315	V4-V	4.8	17:13:17			0.80%						
9/25/95	Rcv Down	45		15		315	V4-V	4.8 CT	17:13:45			0.49%						

TABLE 3: Flight 3

Date	Aircraft Config	Range A15	Range A3	Range D1A	Range D1B	Aircraft Heading	Antenna	Data Rate (KBPS)	Time	BER A15	BER A3	BER D1A	BER D1B	SND A3	SND A15	MSG RCV	RPL RCV	NOTES
9/25/95	Rcv Down	25		12		20	V4-V	4.8	15:29:08			0.72%						
9/25/95	Rcv Down	25		12		TURN	V4-V	4.8	15:29:44			0.86%						
9/25/95	Rcv Down	25		12		200	V4-V	4.8	15:31:05			0.67%						
9/25/95	Rcv Down	25		12		200	V4-V	4.8	15:31:43			0.75%						
9/25/95	Rcv Down	25		12		200	V4-V	4.8	15:32:20			0.67%						
9/25/95	Rcv Down	25		12		20	V4-V	4.8	15:34:04			0.67%						
9/25/95	Rcv Down	25		12		20	V4-V	4.8	15:34:35			0.62%						
9/25/95	Rcv Down	30		7		200	V50-V	4.8	15:39:36			1.64%						
9/25/95	Rcv Down	30		7		200	V50-V	4.8	15:40:37			1.65%						
9/25/95	Rcv Down	30		7		200	V4-V	4.8	15:41:45			0.48%						
9/25/95	Rcv Down	30		7		200	V4-V	4.8	15:42:25			0.46%						
9/25/95	Rcv Down	30		7		20	V4-V	4.8	15:44:05			0.51%						
9/25/95	Rcv Down	30		7		20	V4-V	4.8	15:44:38			0.53%						
9/25/95	Rcv Down	30		7		20	V4-V	4.8	15:45:16			0.55%						
9/25/95	Rcv Down	30		7		20	V50-V	4.8	15:45:53			1.41%						
9/25/95	Rcv Down	30		7		20	V50-V	4.8	15:46:23			1.49%						
9/25/95	Rcv Down	35		2		200	V4-V	16	16:05:10			1.40%						
9/25/95	Rcv Down	35		2		200	V4-V	16	16:05:44			1.91%						
9/25/95	Rcv Down	35		2		200	V4-V	4.8	16:06:30			0.49%						
9/25/95	Rcv Down	35		2		200	V4-V	4.8	16:07:02			0.46%						
9/25/95	Rcv Down	35		2		20	V4-V	16	16:09:05			2.55%						
9/25/95	Rcv Down	35		2		20	V4-V	16	16:09:22			3.29%						
9/25/95	Rcv Down	35		2		20	V4-V	4.8	16:10:20			0.61%						
9/25/95	Rcv Down	35		2		20	V4-V	4.8	16:10:55			0.73%						
9/25/95	Rcv Down	40		7		200	V4-V	4.8	16:16:10			0.57%						
9/25/95	Rcv Down	40		7		200	V4-V	4.8	16:17:00			0.54%						
9/25/95	Rcv Down	40		7		200	V4-V	4.8	16:17:34			0.52%						
9/25/95	Rcv Down	40		7		20	V4-V	4.8	16:19:08			0.66%						
9/25/95	Rcv Down	40		7		20	V4-V	4.8	16:19:40			0.65%						
9/25/95	Rcv Down	45		15		200	V4-V	4.8	16:34:50			0.67%						
9/25/95	Rcv Down	45		15		200	V4-V	4.8	16:35:20			0.81%						
9/25/95	Rcv Down	45		15		20	V4-V	4.8	16:40:50			0.52%						
9/25/95	Rcv Down	45		15		20	V4-V	4.8	16:41:23			0.40%						
9/25/95	Rcv Down	45		15		20	V4-V	4.8 CT	16:42:30			0.27%						
9/25/95	Rcv Down	45		15		20	V4-V	4.8 CT	16:43:30			0.29%						

TABLE 4: Flight 4

Date	Aircraft Config	Range A15	Range A3	Range D1A	Range D1B	Aircraft Heading	Antenna	Data Rate (KBPS)	Time	BER A15	BER A3	BER D1A	BER D1B	SND A3	SND A15	MSG RCV	RPL RCV	NOTES
9/27/95	Rcv Down	12	15			29	MP4-V	4.8	19:58:28	NDS								
9/27/95	Rcv Down	12	13			29	MP4-V	4.8	19:59:03	NDS								
9/27/95	Rcv Down	10	13			29	MP4-V	4.8	20:00:25	NDS								
9/27/95	Rcv Down	10	12			29	MP4-V	4.8	20:01:35	NDS								
9/27/95	Rcv Down	10	10			29	MP4-V	4.8	20:04:13	NDS								
9/27/95	Rcv Down	10	9			29	MP4-V	4.8	20:06:08	NDS								
9/27/95	Rcv Down	14	6			29	MP4-V	4.8	20:07:24	NDS								
9/27/95	Rcv Down	15	5			29	MP4-V	4.8	20:08:15	13.80%								
9/27/95	Rcv Down	15	5			135	MP4-V	4.8	20:11:37	16.90%								
9/27/95	Rcv Down	15	5			135	MP4-V	4.8	20:13:27		1.75%							
9/27/95	Rcv Down	15	5			315	MP4-V	4.8	20:15:54		1.93%							
9/27/95	Rcv Down	15	5			315	MP4-V	4.8	20:17:40		1.69%							
9/27/95	Rcv Down	21.5	25			180	V50-V	16	20:31:16		1.87%							
9/27/95	Rcv Down	21.5	25			90	V50-V	16 CT	20:36:12		1.54%							
9/27/95	Rcv Down	21.5	25			90	V50-V	16	20:36:39		1.82%							
9/27/95	Rcv Down	21.5	25			90	V50-V	16	20:37:06		0.76%							
9/27/95	Rcv Down	21.5	25			90	V4-V	4.8	20:37:08		0.28%							
9/27/95	Rcv Down	21.5	25			90	V50-V	4.8 CT	20:39:36		1.77%							
9/27/95	Rcv Down	21.5	25			90	V4-V	4.8 CT	20:40:15		NS							
9/27/95	Rcv Down	21.5	25			360	V50-V	4.8 CT	20:41:40		1.88%							
9/27/95	Rcv Down	21.5	25			360	V4-V	4.8 CT	20:42:28		NS							
9/27/95	Rcv Down	21.5	25			360	V4-V	4.8 CT	20:43:45		0.01%							
9/27/95	Rcv Down	21.5	25			360	V4-V	4.8 CT	20:44:00		0.00%							
9/27/95	Rcv Down	21.5	25			360	V4-V	4.8	20:44:30		0.28%							
9/27/95	Rcv Down	21.5	25			360	V50-V	4.8	20:45:06		1.79%							
9/27/95	Rcv Down	21.5	25			360	V4-V	4.8	20:46:03		0.73%							
9/27/95	Rcv Down	21.5	25			360	V4-V	4.8 CT	20:46:20		0.51%							
9/27/95	Rcv Down	21.5	25			360	V50-V	16 CT	20:46:42		1.42%							
9/27/95	Rcv Down	21.5	25			270	V4-V	16	20:47:59		0.80%							
9/27/95	Rcv Down	21.5	25			270	V4-V	16 CT	20:48:30		0.62%							
9/27/95	Rcv Down	21.5	25			270	V50-V	16 CT	20:48:49		1.80%							
9/27/95	Rcv Down	21.5	25			270	V4-V	4.8 CT	20:49:23		0.01%							

TABLE 4: Flight 4

Date	Aircraft Config	Range A15	Range A3	Range D1A	Range D1B	Aircraft Heading	Antenna	Data Rate (KBPS)	Time	BER A15	BER A3	BER D1A	BER D1B	SND A3	SND A15	MSG RCV	RPL RCV	NOTES
9/27/95	Rcv Down	21.5	25			270	V50-V	4.8 CT	20:50:06		1.82%							
9/27/95	Rcv Down	21.5	25			270	V50-V	4.8	20:50:45		1.99%							
9/27/95	Rcv Down	21.5	25			270	V4-V	4.8	20:51:26		0.30%							
9/27/95	Rcv Down	21.5	25			45	V4-V	4.8	20:53:44		0.27%							
9/27/95	Rcv Down	21.5	25			45	V4-V	4.8 CT	20:54:56		0.02%							
9/27/95	Rcv Down	21.5	25			45	V4-V	4.8 CT	20:56:00		0.40%							
9/27/95	Rcv Down	21.5	25			45	V4-V	4.8	20:56:23		0.70%							
9/27/95	Rcv Down	21.5	25			135	V4-V	4.8	20:58:49		0.90%							
9/27/95	Rcv Down	21.5	25			135	V4-V	4.8 CT	20:59:24		0.76%							
9/27/95	Rcv Down	21.5	25			135	V4-V	4.8 CT	20:59:51		0.03%							
9/27/95	Rcv Down	21.5	25			135	V4-V	4.8	21:00:34		0.25%							
9/27/95	Rcv Down	21.5	25			225	V4-V	4.8	21:02:25		0.26%							
9/27/95	Rcv Down	21.5	25			225	V4-V	4.8 CT	21:03:05		0.02%							
9/27/95	Rcv Down	21.5	25			225	V4-V	16 CT	21:03:45		0.92%							
9/27/95	Rcv Down	21.5	25			225	V4-V	16	21:04:18		1.10%							
9/27/95	Rcv Down	21.5	25			315	V4-V	16	21:06:00		1.53%							
9/27/95	Rcv Down	21.5	25			315	V4-V	16 CT	21:06:26		0.94%							
9/27/95	Rcv Down	21.5	25			315	V4-V	4.8 CT	21:06:56		0.02%							
9/27/95	Rcv Down	21.5	25			315	V4-V	4.8	21:07:37		0.26%							
9/27/95	Rcv Down	21.5	25			180	V4-V	4.8	21:16:05		0.26%							
9/27/95	Rcv Down	21.5	25			180	V4-V	4.8 CT	21:17:08		0.02%							
9/27/95	Rcv Down	21.5	25			180	V4-V	16 CT	21:17:51		0.73%							
9/27/95	Rcv Down	21.5	25			180	V4-V	16	21:18:22		1.07%							
9/27/95	Rcv Down	21.5	29			90	V4-V	16	21:22:50					X		X		
9/27/95	Rcv Down	21.5	29			90	V4-V	16	21:23:30					X		X		
9/27/95	Rcv Down	21.5	29			90	V4-V	4.8	21:24:18					X		X	X	
9/27/95	Rcv Down	21.5	29			90	V4-V	4.8	21:24:53						X	X	X	
9/27/95	Rcv Down	21.5	29			90	V4-V	16	21:26:26						X	X		
9/27/95	Rcv Down	21.5	29			360	V4-V	16	21:28:15					X		X		
9/27/95	Rcv Down	21.5	29			360	V4-V	16 CT	21:29:20					X		X	X	
9/27/95	Rcv Down	21.5	29			360	V4-V	16 CT	21:30:02						X	X	X	
9/27/95	Rcv Down	21.5	29			360	V4-V	16	21:31:04						X	X		
9/27/95	Rcv Down	21.5	29			270	V4-V	16	21:32:41					X				
9/27/95	Rcv Down	21.5	29			270	V4-V	16	21:33:12					X				

TABLE 4: Flight 4

Date	Aircraft Config	Range A15	Range A3	Range D1A	Range D1B	Aircraft Heading	Antenna	Data Rate (KBPS)	Time	BER A15	BER A3	BER D1A	BER D1B	SND A3	SND A15	MSG RCV	RPL RCV	NOTES
9/27/95	Rcv Down	21.5	29			270	V4-V	16 CT	21:33:56					X				
9/27/95	Rcv Down	21.5	29			270	V4-V	4.8 CT	21:34:25					X		X		
9/27/95	Rcv Down	21.5	29			270	V4-V	4.8 CT	21:35:05					X		X	X	
9/27/95	Rcv Down	21.5	29			270	V4-V	4.8	21:36:02						X	X	X	
9/27/95	Rcv Down	21.5	29			45	V4-V	16	21:37:31						X	X		
9/27/95	Rcv Down	21.5	29			45	V4-V	16 CT	21:38:10						X	X	X	
9/27/95	Rcv Down	21.5	29			45	V4-V	4.8 CT	21:38:48						X	X	X	
9/27/95	Rcv Down	21.5	29			45	V4-V	4.8	21:39:33						X	X	X	
9/27/95	Rcv Down	21.5	29			45	V4-V	4.8	21:40:12					X		X	X	
9/27/95	Rcv Down	21.5	29			315	V4-V	16 CT	21:41:42					X				
9/27/95	Rcv Down	21.5	29			315	V4-V	16 CT	21:42:19					X		X	X	
9/27/95	Rcv Down	21.5	29			315	V4-V	16	21:43:11					X		X		
9/27/95	Rcv Down	21.5	29			315	V4-V	4.8	21:44:09						X	X	X	
9/27/95	Rcv Down	21.5	29			225	V4-V	16	21:45:23						X	X		
9/27/95	Rcv Down	21.5	29			225	V4-V	16 CT	21:46:02						X	X		
9/27/95	Rcv Down	21.5	29			225	V4-V	4.8 CT	21:47:22						X	X		
9/27/95	Rcv Down	21.5	29			225	V4-V	4.8 CT	21:48:20					X				
9/27/95	Rcv Down	21.5	29			135	V4-V	16 CT	21:51:46					X				
9/27/95	Rcv Down	21.5	29			20	V4-V	16 CT	21:52:56						X	X		
9/27/95	Rcv Down	21.5	29			20	V4-V	4.8 CT	21:53:34					X		X		
9/27/95	Rcv Down	21.5	29			20	V4-V	4.8 CT	21:54:09					X		X		
9/27/95	Rcv Down	21.5	29			20	V4-V	4.8 CT	21:55:03					X				

TABLE 5: Flight 5

Date	Aircraft Config	Range A15	Range A3	Range D1A	Range D1B	Aircraft Heading	Antenna	Data Rate (KBPS)	Time	BER A15	BER A3	BER D1A	BER D1B	SND A3	SND A15	MSG RCV	RPL RCV	NOTES
9/28/95	Rcv Down	27			27	180	V50-V	4.8	17:27:20				0.22%					
9/28/95	Rcv Down	27			27	180	V50-V	4.8	17:29:00				0.29%					
9/28/95	Rcv Down	27			27	360	V50-V	4.8	17:30:00				0.48%					
9/28/95	Rcv Down	27			27	360	V4-V	4.8	17:34:45				0.70%					
9/28/95	Rcv Down	27			27	360	V50-V	16	17:36:00				1.91%					TURN
9/28/95	Rcv Down	27			27	180	V50-V	16	17:37:00				1.53%					
9/28/95	Rcv Down	30			25	100	V50-V	4.8	17:40:00				0.28%					
9/28/95	Rcv Down	35			20	100	V4-V	4.8	17:42:00	2.83%								
9/28/95	Rcv Down	35			20	360	V4-V	4.8	17:43:00	0.61%								
9/28/95	Rcv Down	35			20	360	V4-V	4.8 CT	17:44:08	0.87%								
9/28/95	Rcv Down	35			20	180	V4-V	4.8 CT	17:46:00	0.24%								
9/28/95	Rcv Down	35			20	180	V4-V	16 CT	17:47:00	3.05%								
9/28/95	Rcv Down	35			20	180	V4-V	16 CT	17:48:00	3.62%								
9/28/95	Rcv Down	35			20	360	V50-V	16 CT	17:50:00				0.77%					
9/28/95	Rcv Down	35			20	360	V50-V	4.8 CT	17:51:00				0.06%					
9/28/95	Rcv Down	35			20	360	V50-V	4.8	17:52:00				0.27%					
9/28/95	Rcv Down	35			20	180	V50-V	4.8	17:54:10				0.22%					
9/28/95	Rcv Down	35			20	180	V50-V	4.8 CT	17:56:32				0.04%					
9/28/95	Rcv Down	35			20	180	V50-V	16 CT	17:57:42				1.32%					
9/28/95	Rcv Down	35			20	360	V50-V	16	17:58:57				1.21%					
9/28/95	Rcv Down	35			20	360	V50-V	16	17:59:40				1.28%					
9/28/95	Rcv Down	40			15	360	V50-V	16	18:06:14				1.42%					
9/28/95	Rcv Down	40			15	360	V50-V	16 CT	18:06:40				1.14%					
9/28/95	Rcv Down	40			15	180	V50-V	16 CT	18:07:15				0.96%					
9/28/95	Rcv Down	40			15	180	V50-V	16	18:07:50				1.27%					
9/28/95	Rcv Down	40			15	180	V50-V	4.8	18:08:20				0.18%					
9/28/95	Rcv Down	40			15	180	V50-V	4.8 CT	18:09:10				0.07%					
9/28/95	Rcv Down	40			15	180	V4-V	4.8 CT	18:11:20	0.63%								
9/28/95	Rcv Down	40			15	360	V4-V	4.8 CT	18:13:00	1.91%								
9/28/95	Rcv Down	40			15	360	V4-V	4.8 CT	18:14:00	0.68%								
9/28/95	Rcv Down	40			15	360	V4-V	4.8	18:15:15	1.77%								
9/28/95	Rcv Down	40			15	360	V4-V	16	18:15:30	5.35%								

TABLE 5: Flight 5

Date	Aircraft Config	Range A15	Range A3	Range D1A	Range D1B	Aircraft Heading	Antenna	Data Rate (KBPS)	Time	BER A15	BER A3	BER D1A	BER D1B	SND A3	SND A15	MSG RCV	RPL RCV	NOTES
9/28/95	Rcv Down	40			15	360	V4-V	16 CT	18:15:50	4.45%								
9/28/95	Rcv Down	40			15	180	V4-V	16 CT	18:17:45	3.09%								
9/28/95	Rcv Down	40			15	180	V4-V	16	18:18:10	2.74%								
9/28/95	Rcv Down	40			15	180	V4-V	4.8	18:18:30	0.21%								
9/28/95	Rcv Down	40			15	180	V4-V	4.8 CT	18:19:30	0.31%								
9/28/95	Rcv Down	42			17	100	V4-V	4.8 CT	18:20:00	3.51%								
9/28/95	Rcv Down	42			17	100	V4-V	4.8	18:22:45	4.84%								
9/28/95	Rcv Down	42			17	100	V50-V	4.8	18:24:45				0.23%					
9/28/95	Rcv Down	42			17	100	V50-V	4.8 CT	18:25:00				0.06%					
9/28/95	Rcv Down	45			20	180	V50-V	4.8 CT	18:26:50				0.22%					
9/28/95	Rcv Down	45			20	180	V50-V	4.8	18:28:00				0.29%					
9/28/95	Rcv Down	45			20	180	V50-V	16	18:29:00				1.62%					
9/28/95	Rcv Down	45			20	180	V50-V	16 CT	18:30:00				1.62%					
9/28/95	Rcv Down	45			20	180	V4-V	16 CT	18:32:00	12.10%								
9/28/95	Rcv Down	45			20	360	V4-V	16 CT	18:33:00	9.20%								
9/28/95	Rcv Down	45			20	360	V4-V	16	18:34:00	7.56%								
9/28/95	Rcv Down	45			20	360	V4-V	4.8	18:35:00	1.82%								
9/28/95	Rcv Down	45			20	360	V4-V	4.8 CT	18:36:00	1.06%								
9/28/95	Rcv Down	45			20	360	V50-V	4.8 CT	18:39:00				0.05%					
9/28/95	Rcv Down	45			20	360	V50-V	4.8	18:40:00				0.22%					
9/28/95	Rcv Down	45			20	360	V50-V	16	18:41:00				0.81%					
9/28/95	Rcv Down	45			20	360	V50-V	16 CT	18:42:00				0.75%					
9/28/95	Rcv Down	45			20	180	V4-V	16 CT	18:44:00	4.57%								
9/28/95	Rcv Down	45			20	180	V4-V	16	18:45:00	9.21%								
9/28/95	Rcv Down	45			20	180	V4-V	4.8	18:46:00	2.15%								
9/28/95	Rcv Down	45			20	180	V4-V	4.8 CT	18:47:00	2.45%								
9/28/95	Rcv Down	47			22	270	V4-V	4.8 CT	18:49:00	3.00%								
9/28/95	Rcv Down	47			22	270	V4-V	16 CT	18:51:00	9.48%								
9/28/95	Rcv Down	50			25	180	V4-V	16 CT	18:52:00	9.69%								
9/28/95	Rcv Down	50			25	180	V4-V	16	18:53:00	10.00%								
9/28/95	Rcv Down	50			25	180	V4-V	4.8	18:54:00	3.59%								
9/28/95	Rcv Down	50			25	180	V4-V	4.8 CT	18:55:00	3.90%								
9/28/95	Rcv Down	50			25	360	V4-V	4.8 CT	18:57:00	3.40%								
9/28/95	Rcv Down	50			25	360	V4-V	4.8	18:58:00	2.90%								

TABLE 5: Flight 5

Date	Aircraft Config	Range A15	Range A3	Range D1A	Range D1B	Aircraft Heading	Antenna	Data Rate (KBPS)	Time	BER A15	BER A3	BER D1A	BER D1B	SND A3	SND A15	MSG RCV	RPL RCV	NOTES
9/28/95	Rcv Down	50			25	360	V4-V	16	18:58:30	11.10%								
9/28/95	Rcv Down	50			25	360	V4-V	16 CT	18:59:00	8.86%								
9/28/95	Rcv Down	50			25	360	V50-V	16 CT	19:00:00				0.72%					
9/28/95	Rcv Down	50			25	360	V50-V	16	19:02:00				1.05%					
9/28/95	Rcv Down	50			25	360	V50-V	4.8	19:02:30				0.21%					
9/28/95	Rcv Down	50			25	360	V50-V	4.8 CT	19:03:00				0.03%					
9/28/95	Rcv Down	50			25	180	V50-V	4.8 CT	19:04:00				0.08%					
9/28/95	Rcv Down	50			25	180	V50-V	4.8	19:05:00				0.29%					
9/28/95	Rcv Down	50			25	180	V50-V	16	19:05:30				1.97%					
9/28/95	Rcv Down	50			25	180	V50-V	16 CT	19:06:00				1.72%					
9/28/95	Rcv Down	50			25	180	V50-V	16 CT	19:09:00	NS								

4.4.2 Test Results

Generally data transmitted from site A15 (simulating the ship) was noticeably better than data received at site A15. This directionality is believed to be due to a larger noise floor at site A15. Cypher Text data at 4.8 KBPS was approximately 30%-50% better than Plain Text. This improvement with Cypher Text was noticed as long as the average BER was less than roughly 3%.

Looking at the data it is obvious that the manpack antenna has serious problems with meeting range requirements transferring data (Figure 1 & 2). At 5 n-miles the manpack antenna can receive with a data BER of approximately 2-3% using either 16 or 4.8 KBPS. The manpack antenna can transmit with a 4.8 KBPS data BER of 10-15% with numerous failures to provide a data link at all. At 16 KBPS the manpack consistently failed to establish a data link.

With both aircraft antenna in the upright orientation, the data also shows that aircraft orientation with respect to the transmitting site is very important. There were cases of widely varying BERs with the transmitting site at close ranges to the aircraft (Figure 3, 8, 23, 24). These fluctuations were not as noticeable when the receive antenna was rotated into the downward position (Figure 4, 10, 25, 26).

With both aircraft antenna in the upright orientation, the system appears to be right on the edge of meeting the minimum range requirements using a vehicular mounted antenna. With an average 4.8 KBPS received BER of 1.01% the system had some data points within requirements and some outside(Tables 1 & 2 and Figures 3, 8, 23, 24).

With the receive antenna rotated into the downward position the system easily meets the minimum range requirement using a 4.8 KBPS data rate (Figures 4,10, 25, 26). A 4.8 KBPS received BER average of .61% was obtained at 40 n-miles and 1.51% at 45 n-miles. The transmitted BER average at 50 watts using a vehicular antenna at 50 n-miles was .18% at 4.8 KBPS and 1.37% at 16 KBPS (Figure 15 & 16).

4.4.3 Data Analysis

The recorded data and radar tracking information was entered into a Microsoft Access database. The actual range and heading information was calculated by comparing the time stamp on the recorded data with the time stamp in the tracking information. The heading information was converted to a reference angle from the aircraft to the remote sites with a range of -180 degrees to +180 degrees. This angle is in respect to the aircraft with zero to the front of the aircraft, negative numbers on the port side of the aircraft (receive) and positive numbers on the starboard side (transmit) of the aircraft.

Data was plotted with respect to RANGE/ANGLE/BER for the various data rates and antenna configurations.

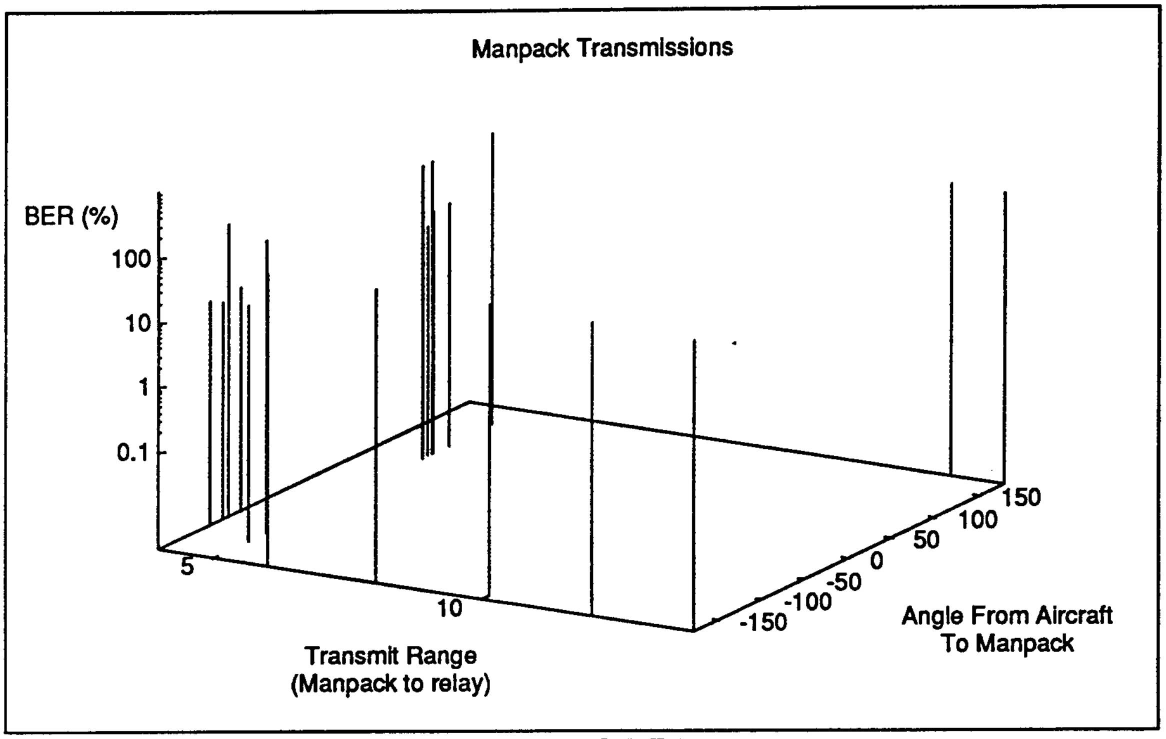

FIGURE 1

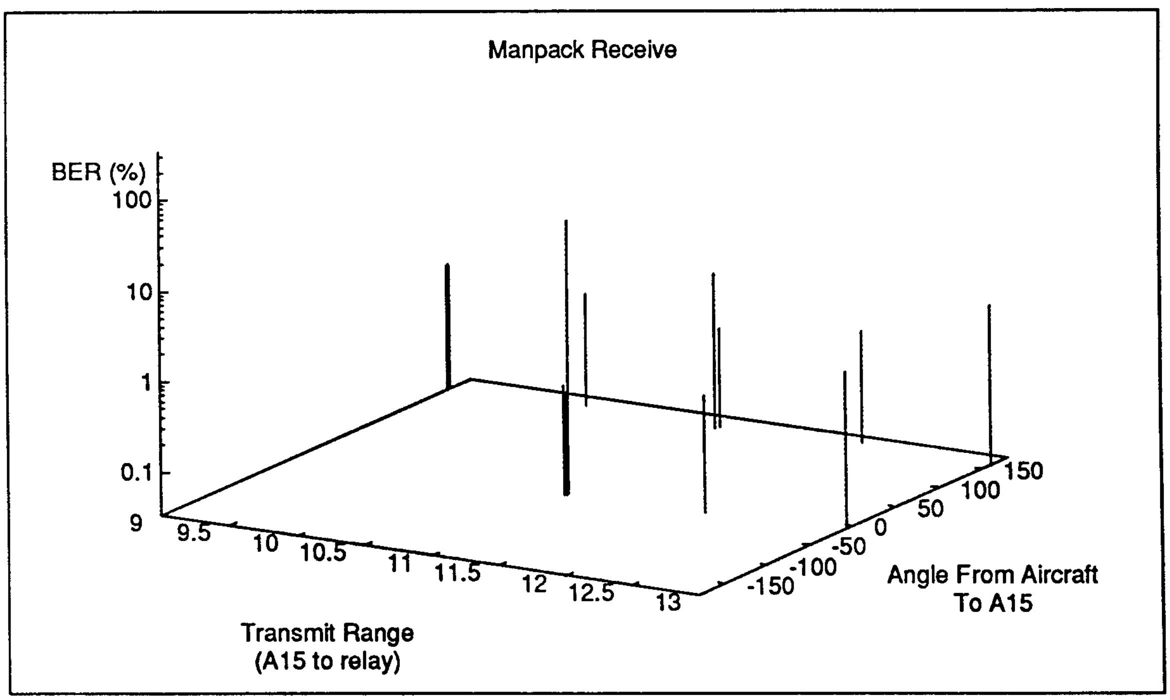

FIGURE 2

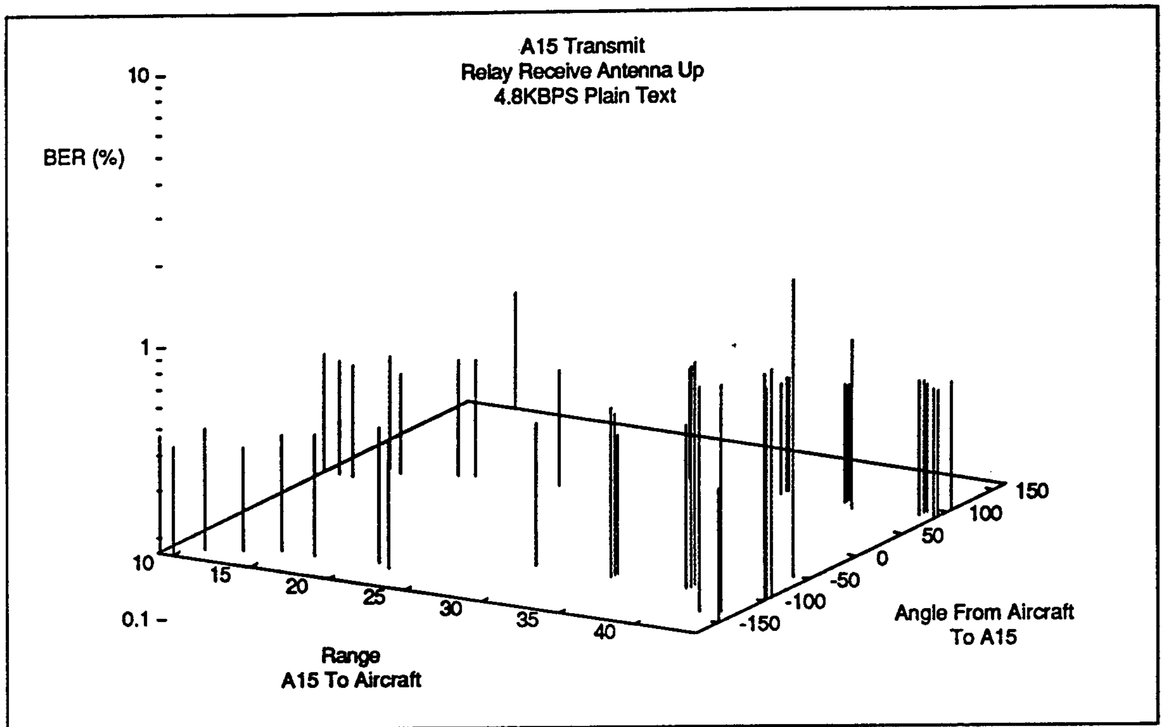

FIGURE 3

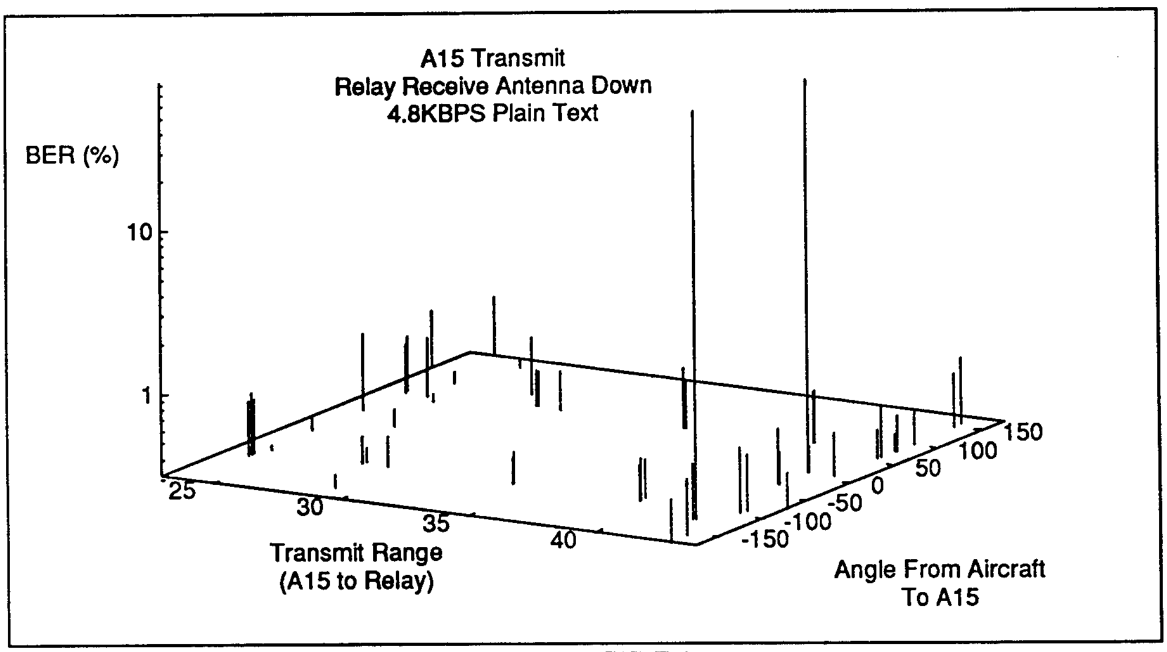

FIGURE 4

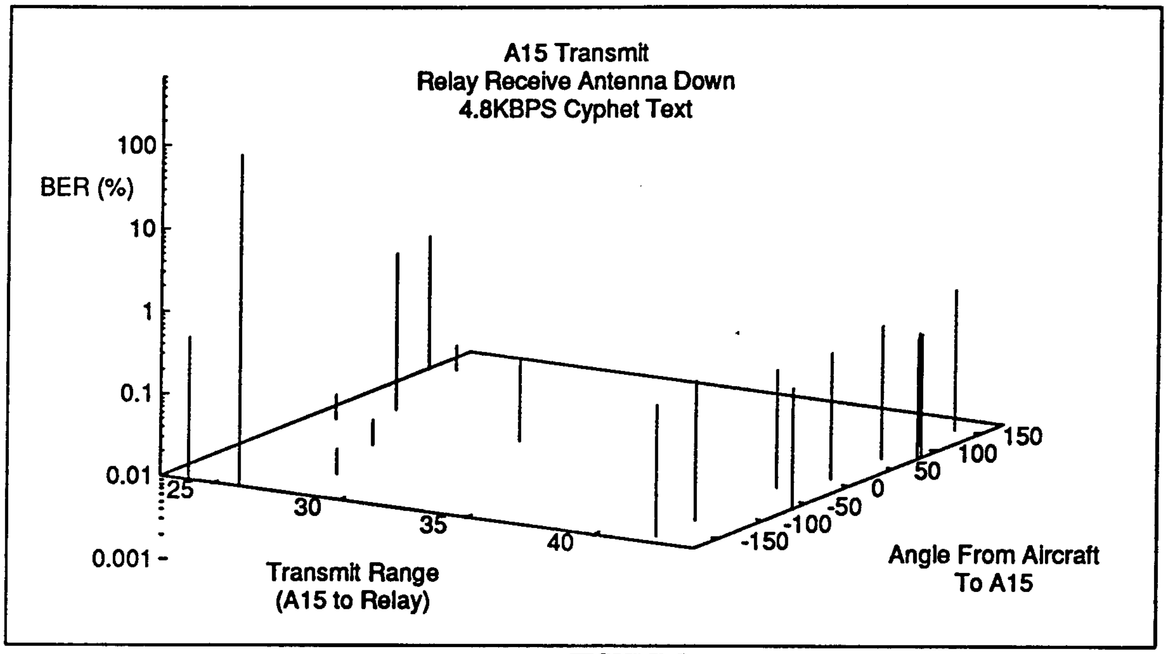

FIGURE 5

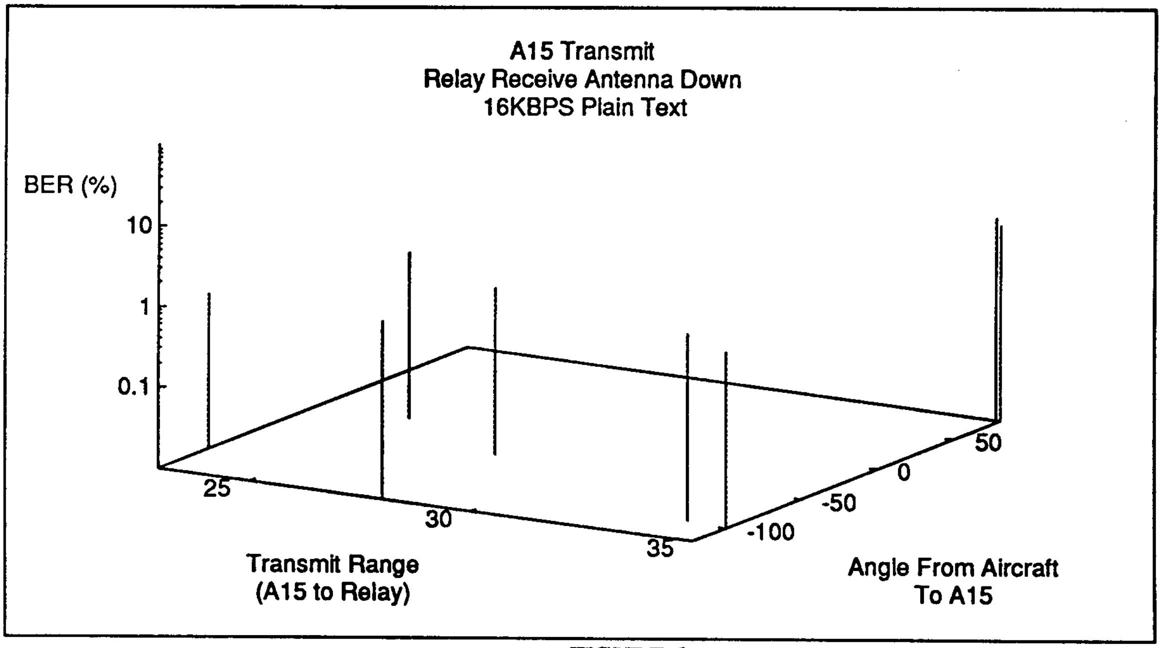

FIGURE 6

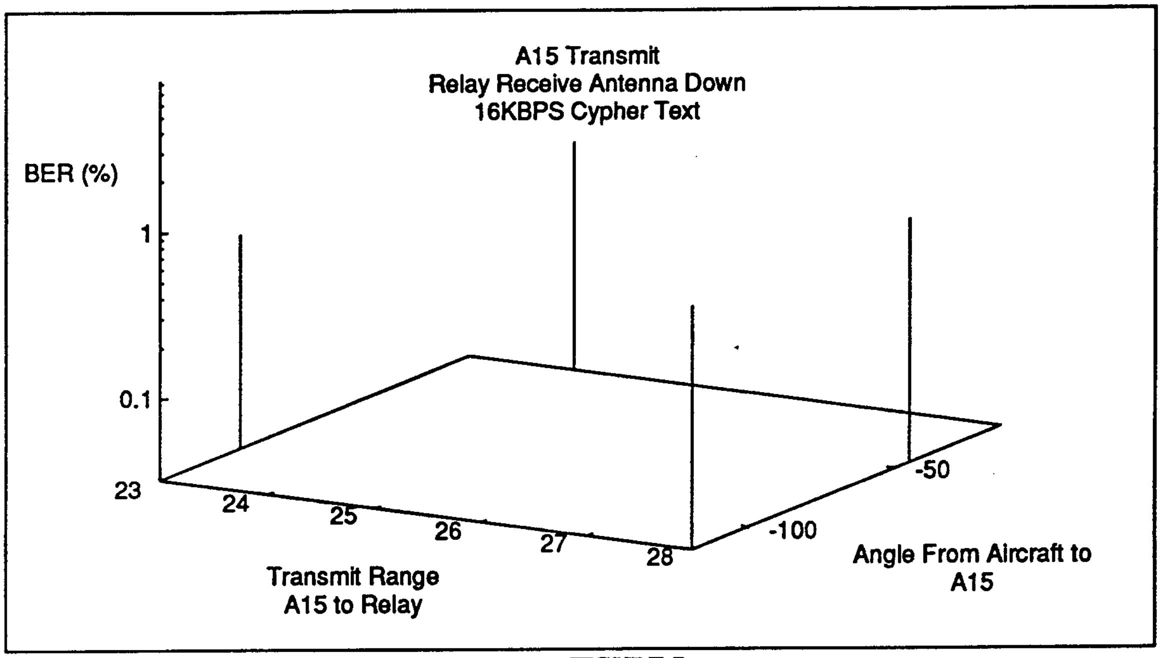

FIGURE 7

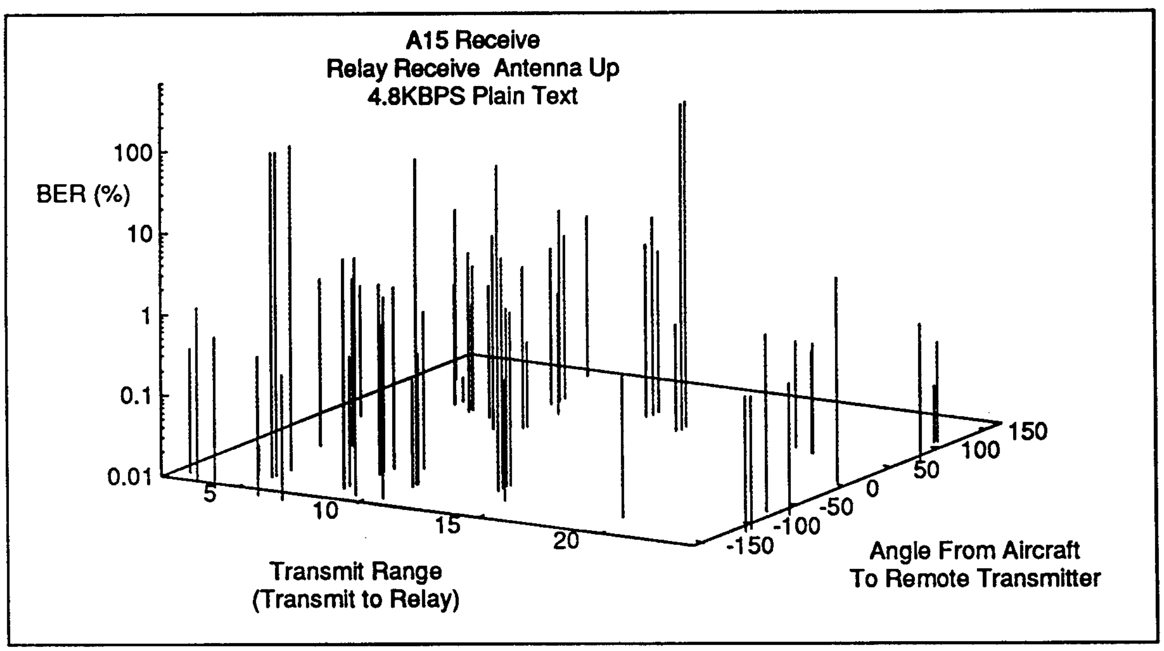

FIGURE 8

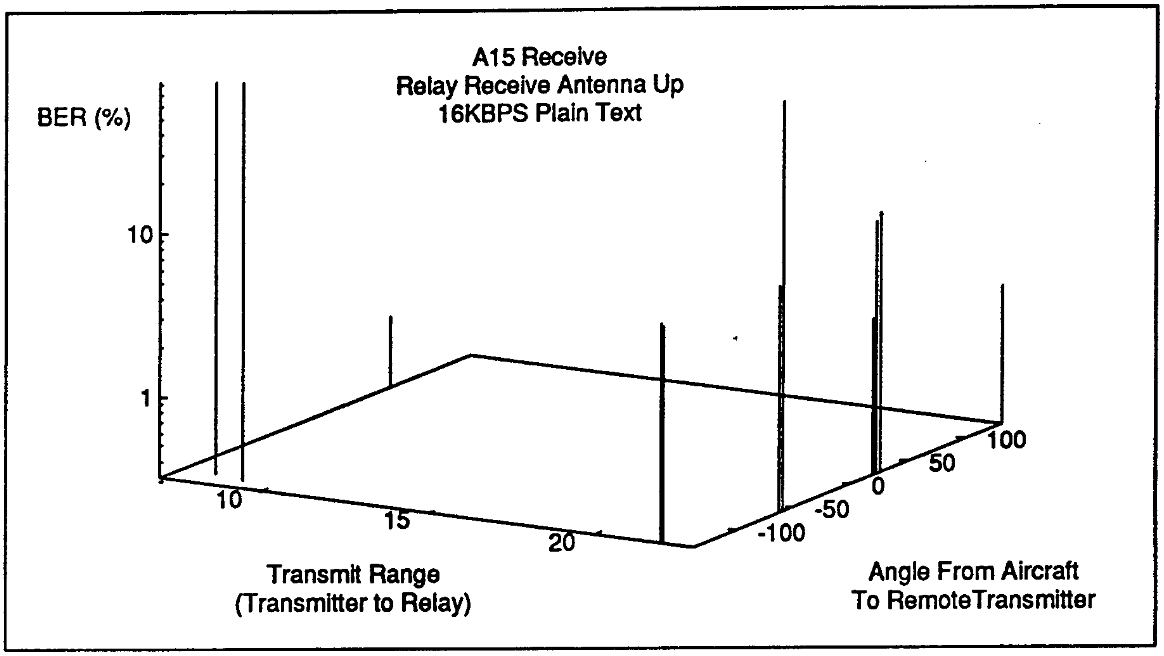

FIGURE 9

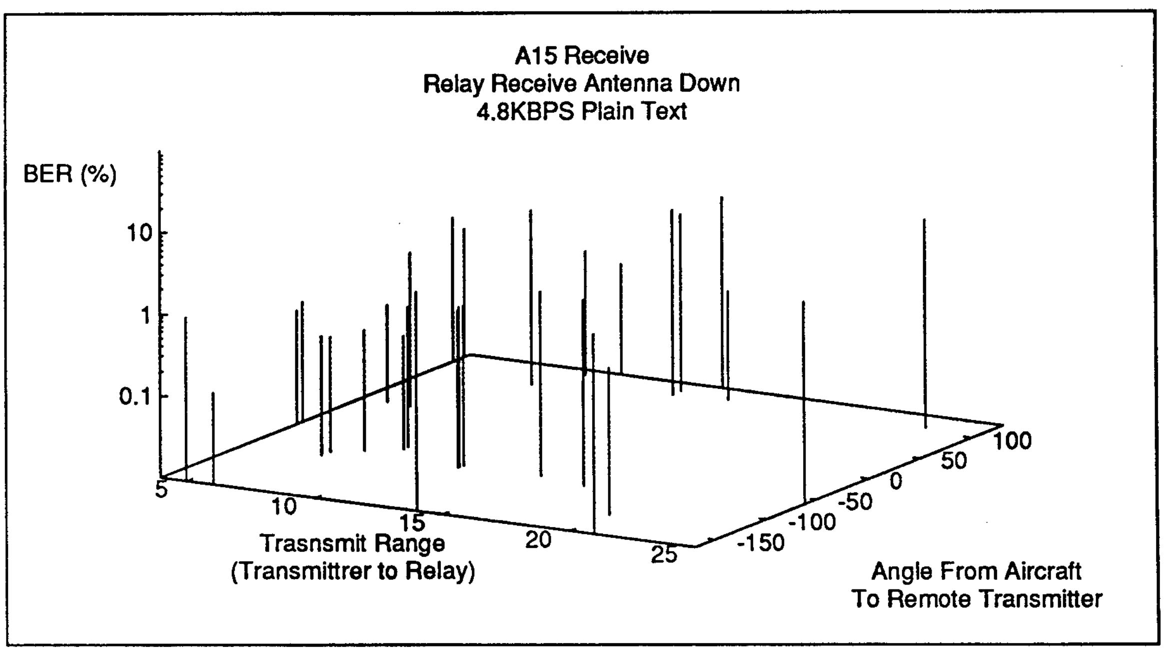

FIGURE 10

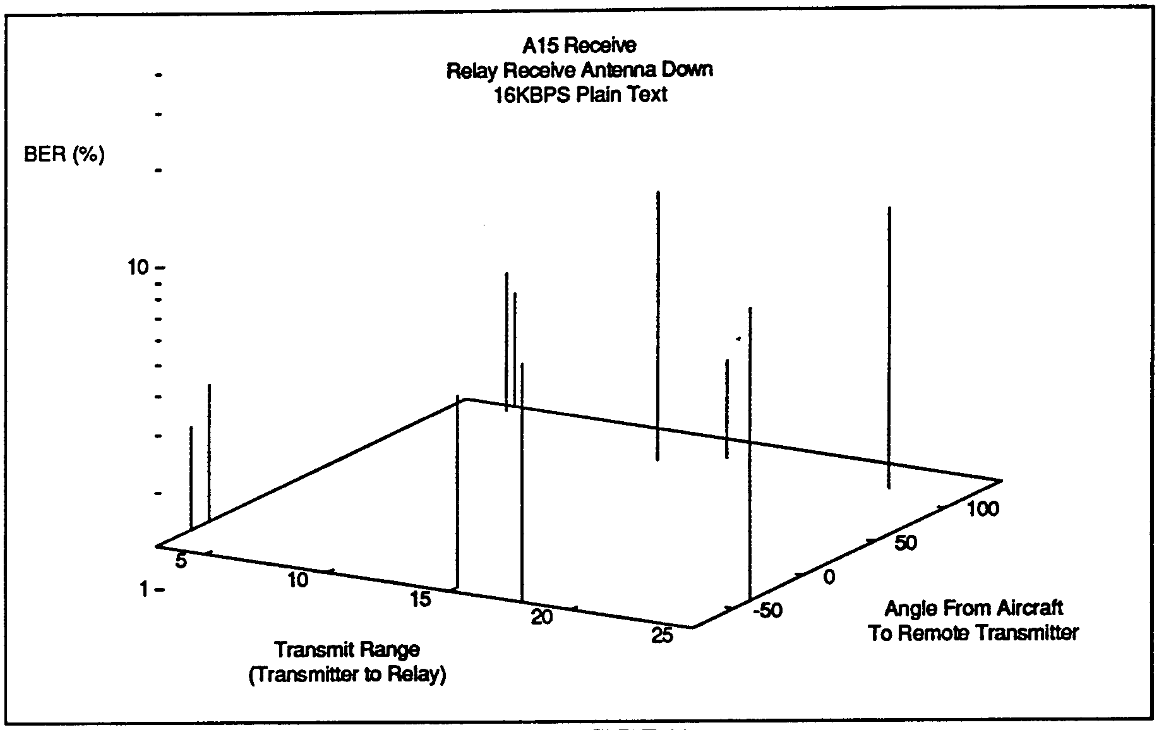

FIGURE 11

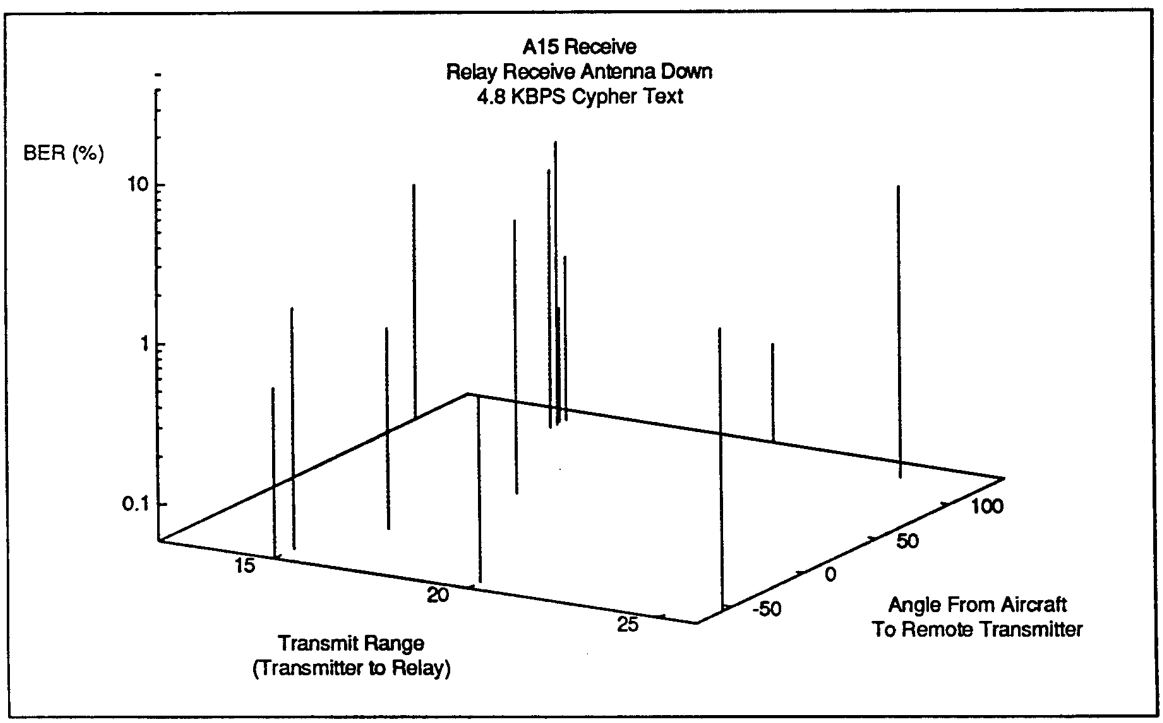

FIGURE 12

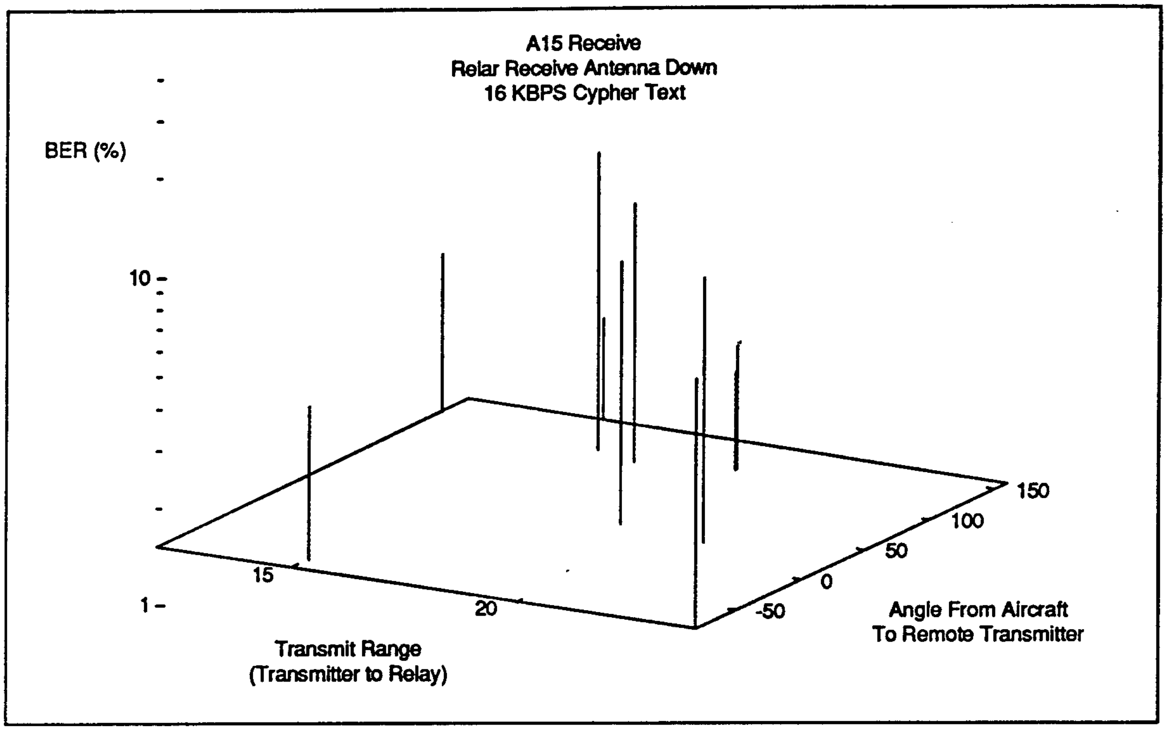

FIGURE 13

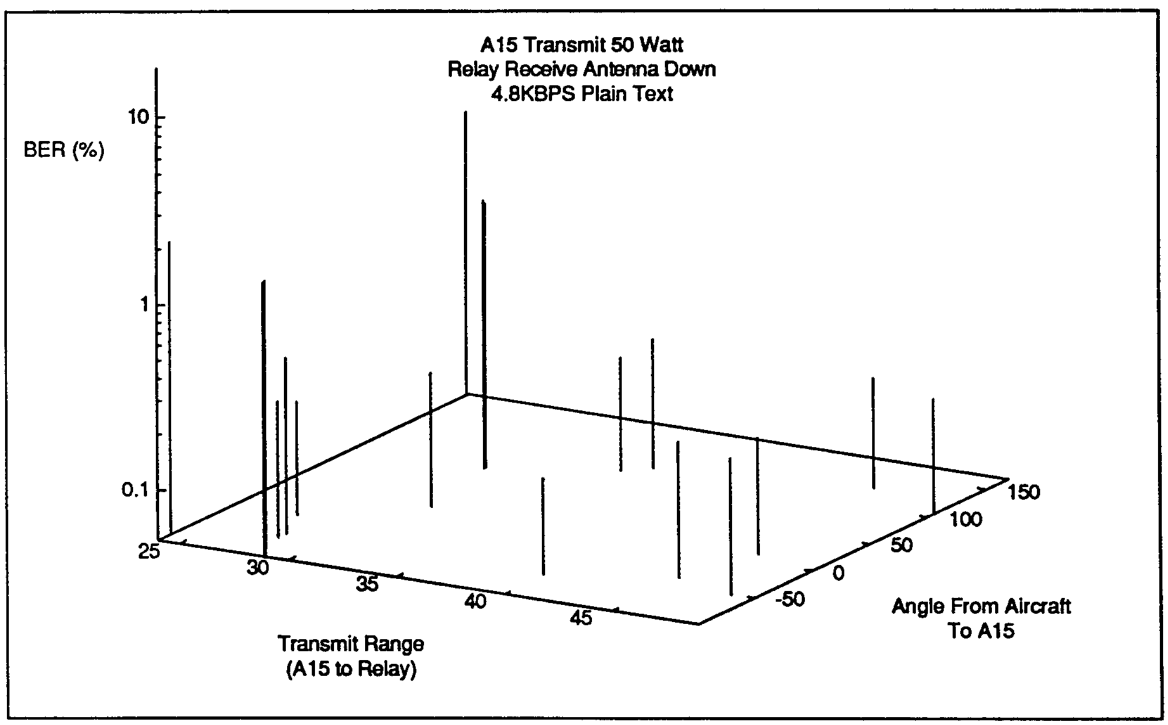

FIGURE 14

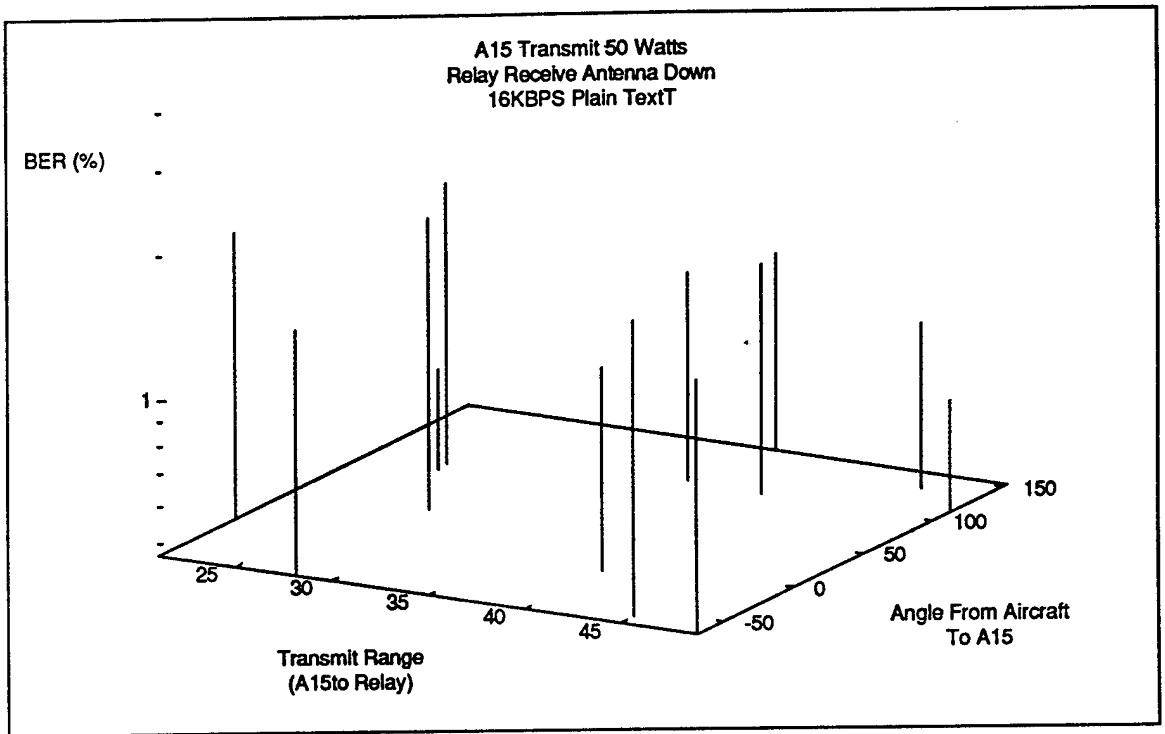

FIGURE 15

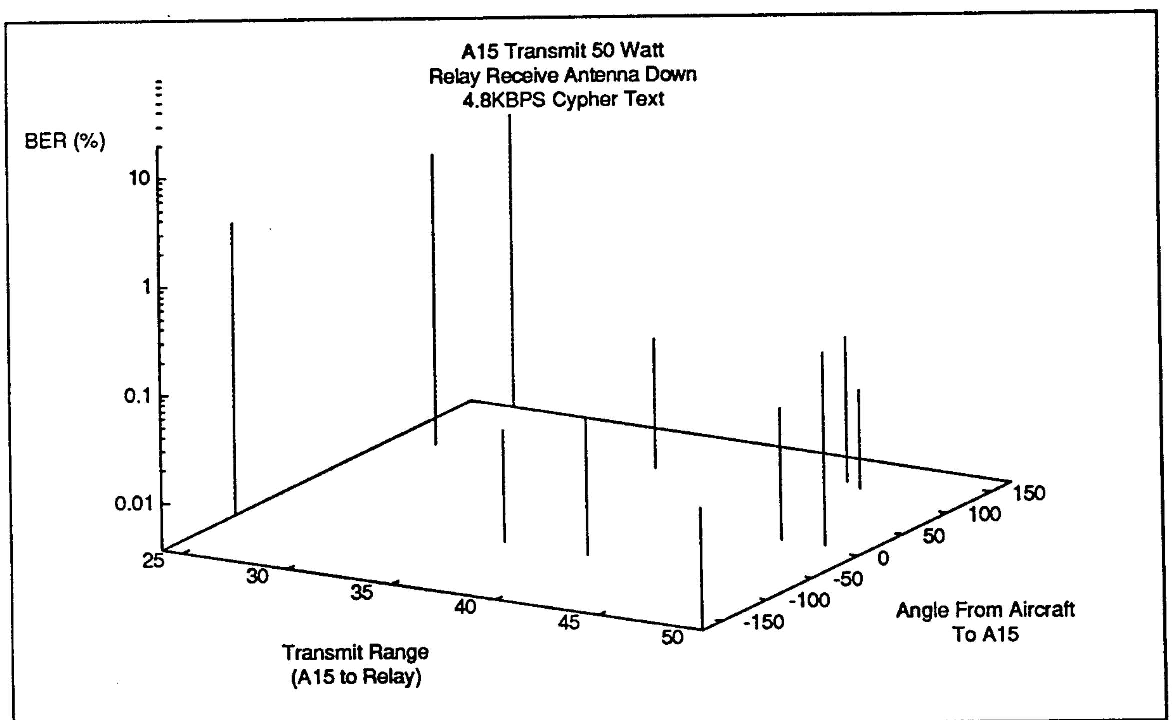

FIGURE 16

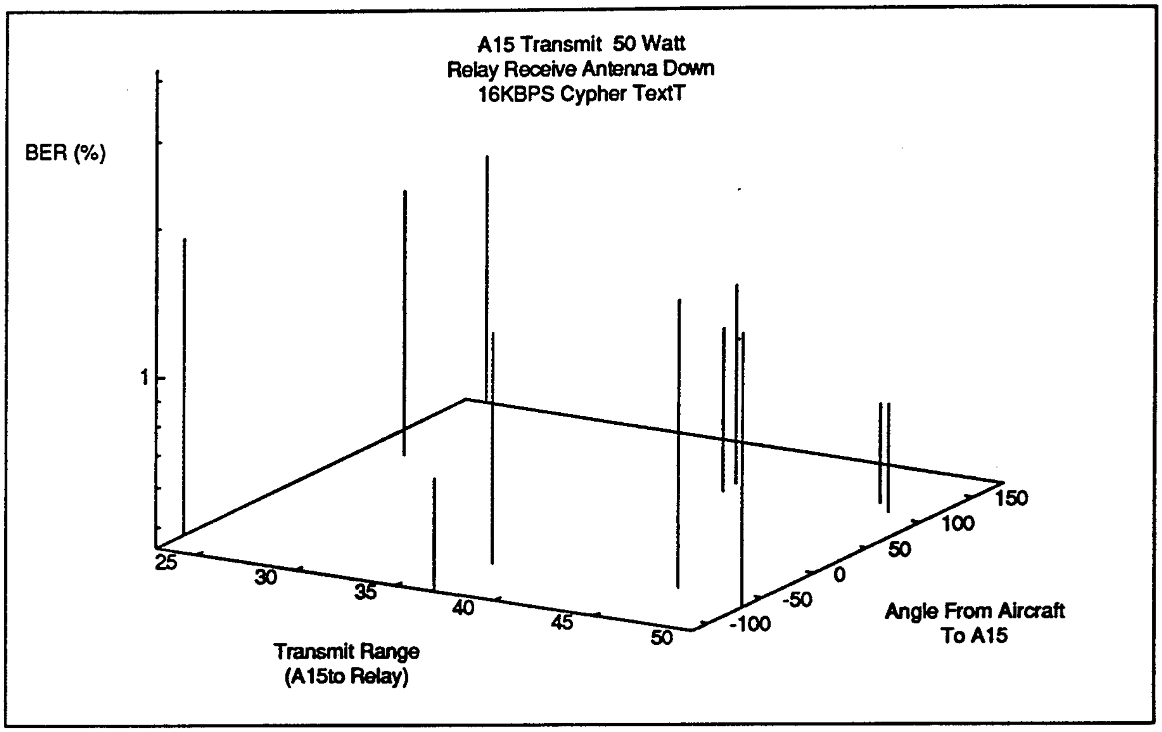

FIGURE 17

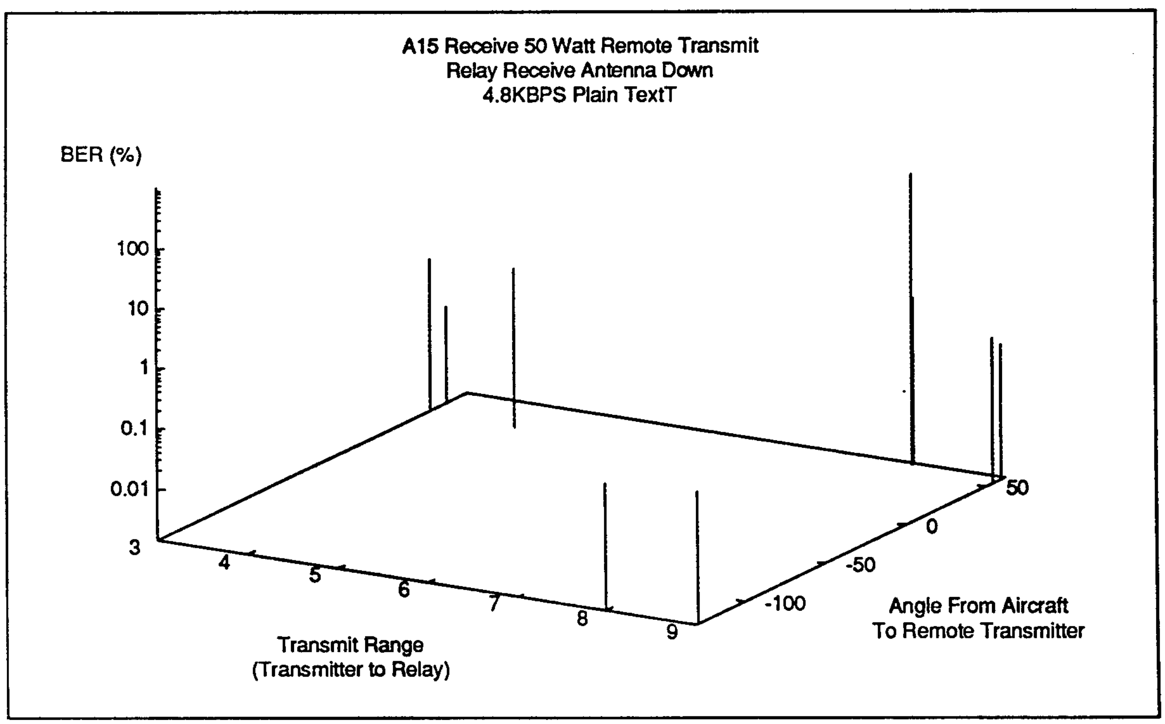

FIGURE 18

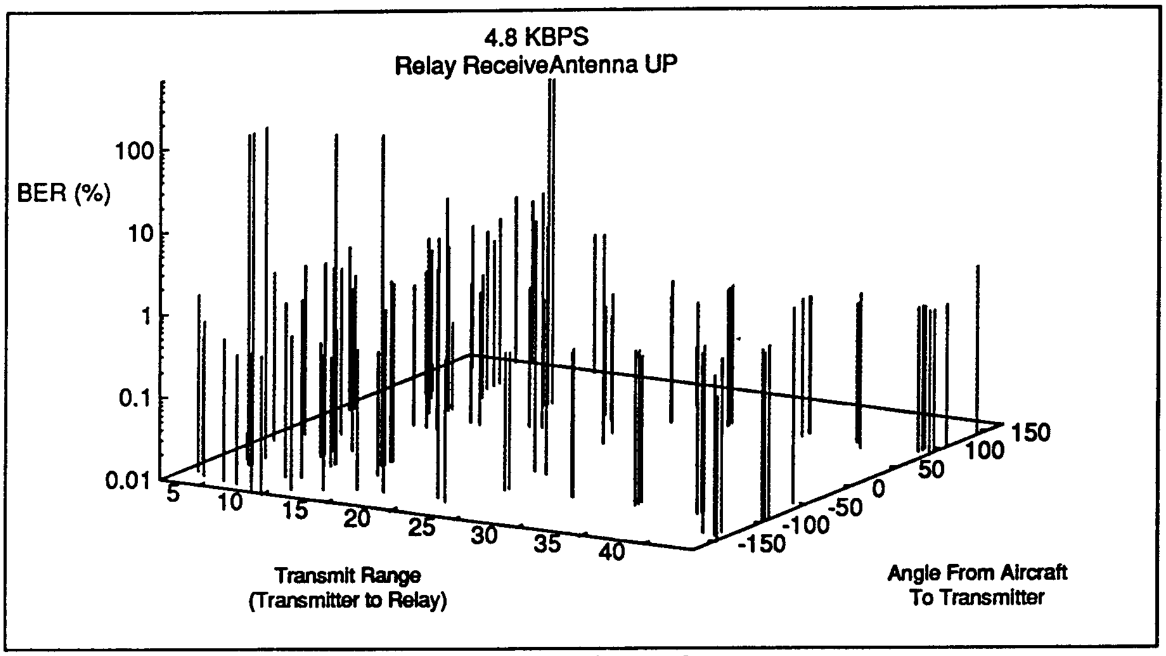

FIGURE 19

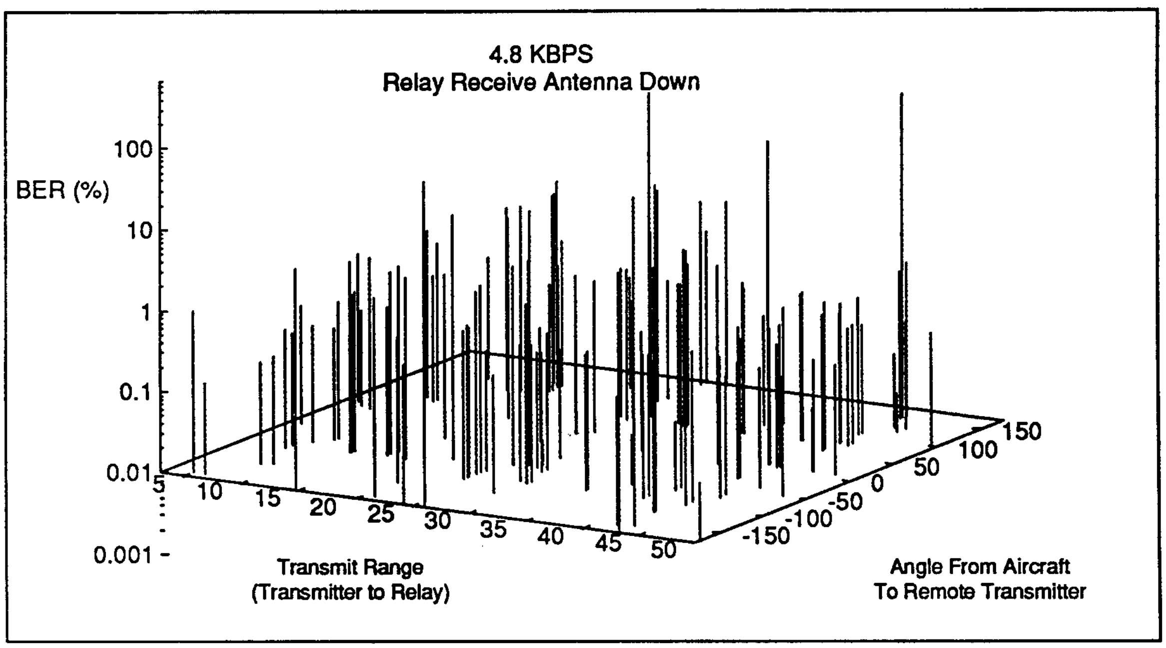

FIGURE 20

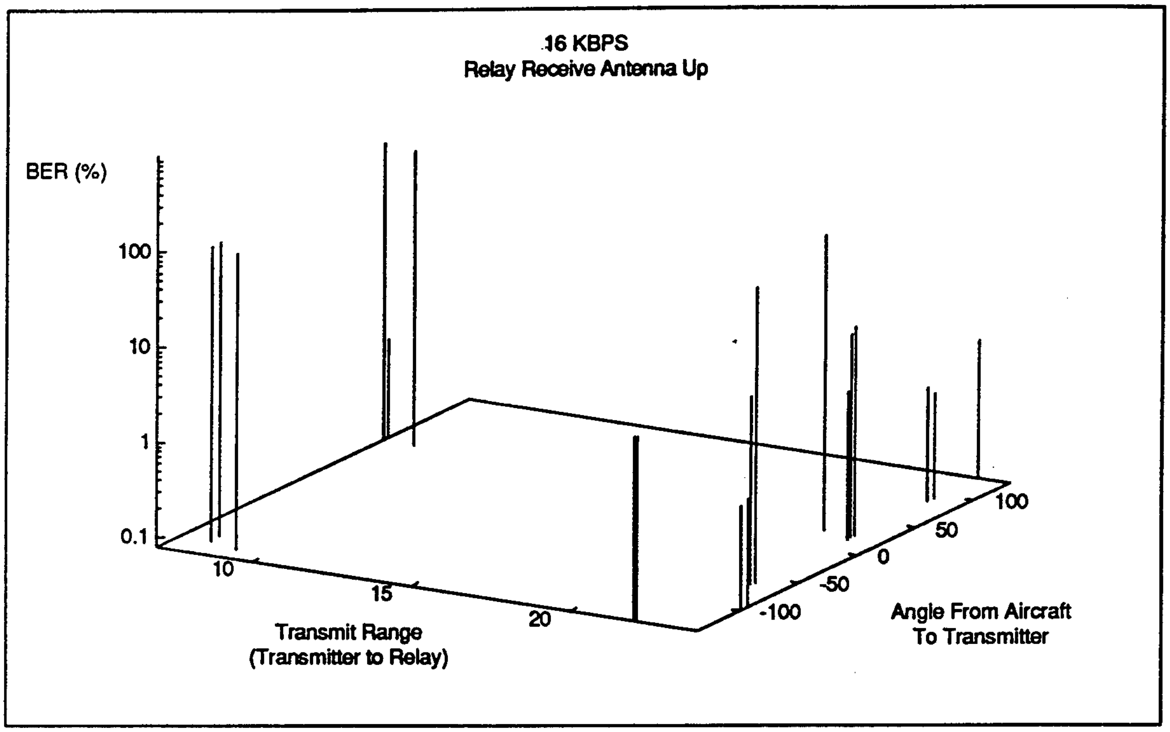

FIGURE 21

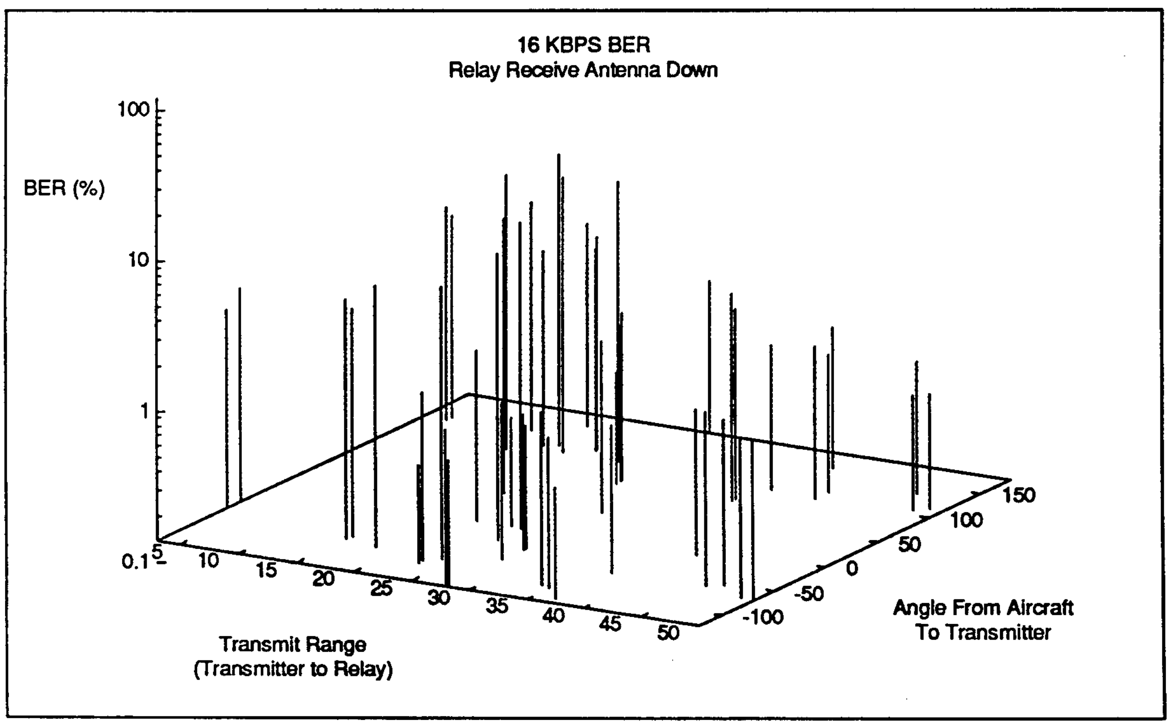

FIGURE 22

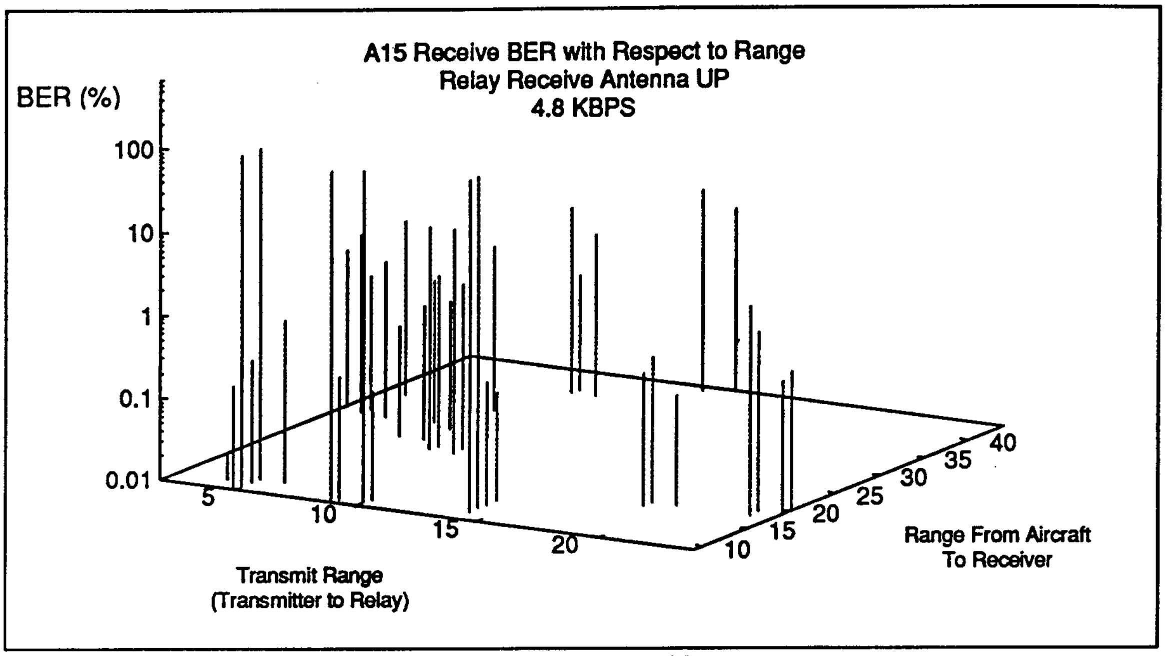

FIGURE 23

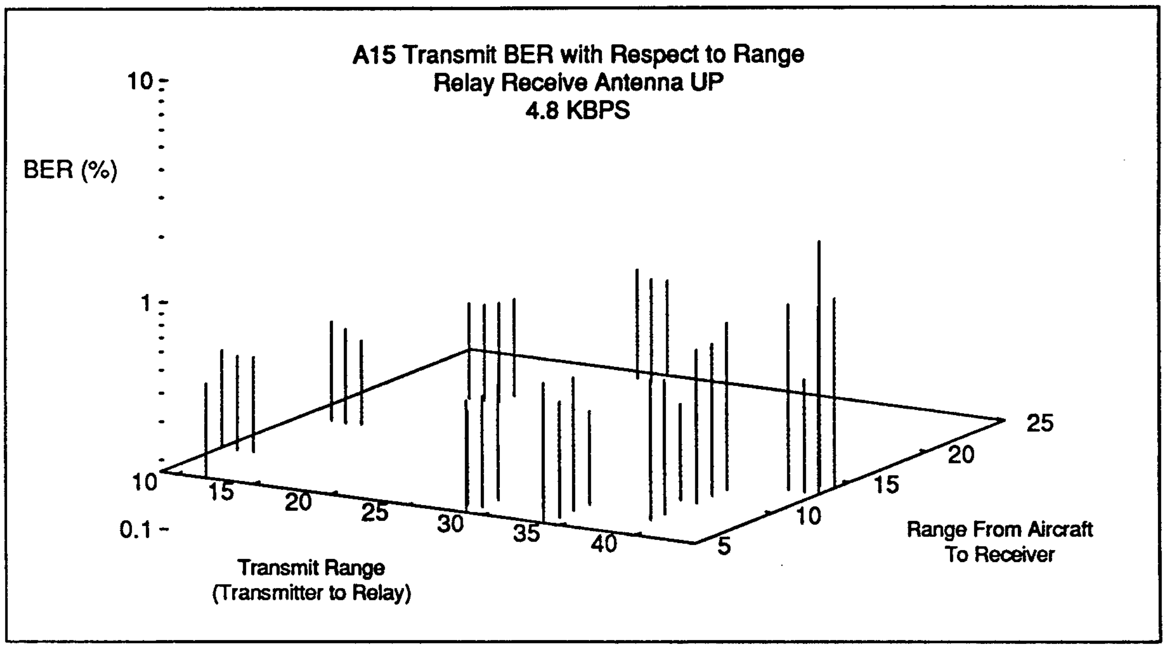

FIGURE 24

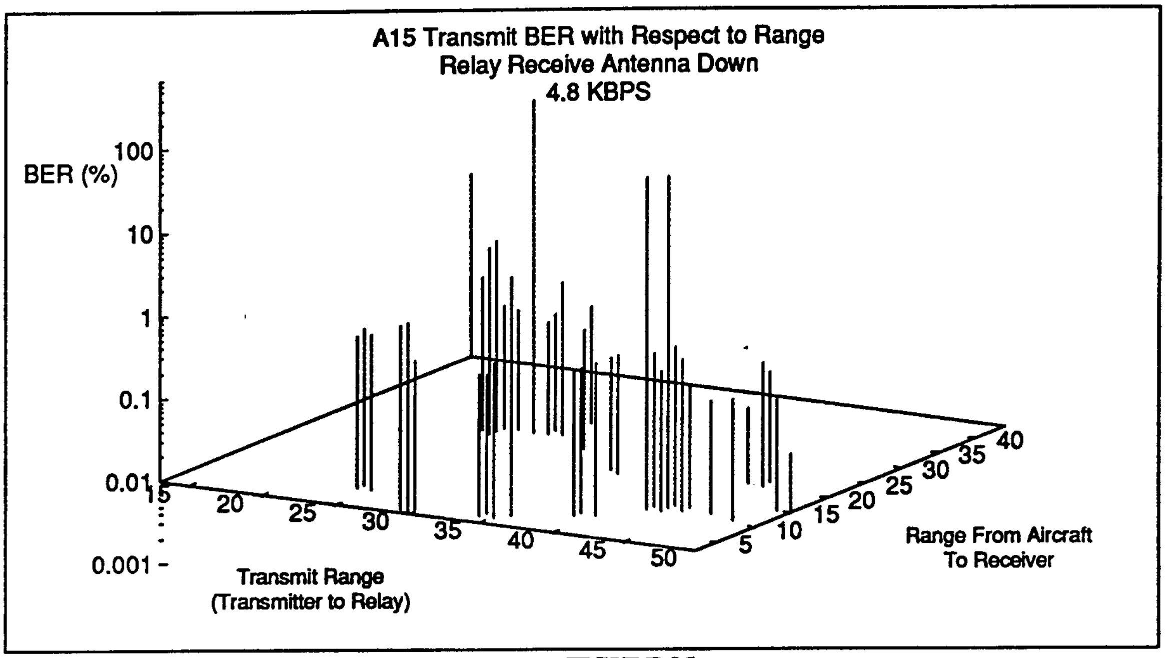

FIGURE 25

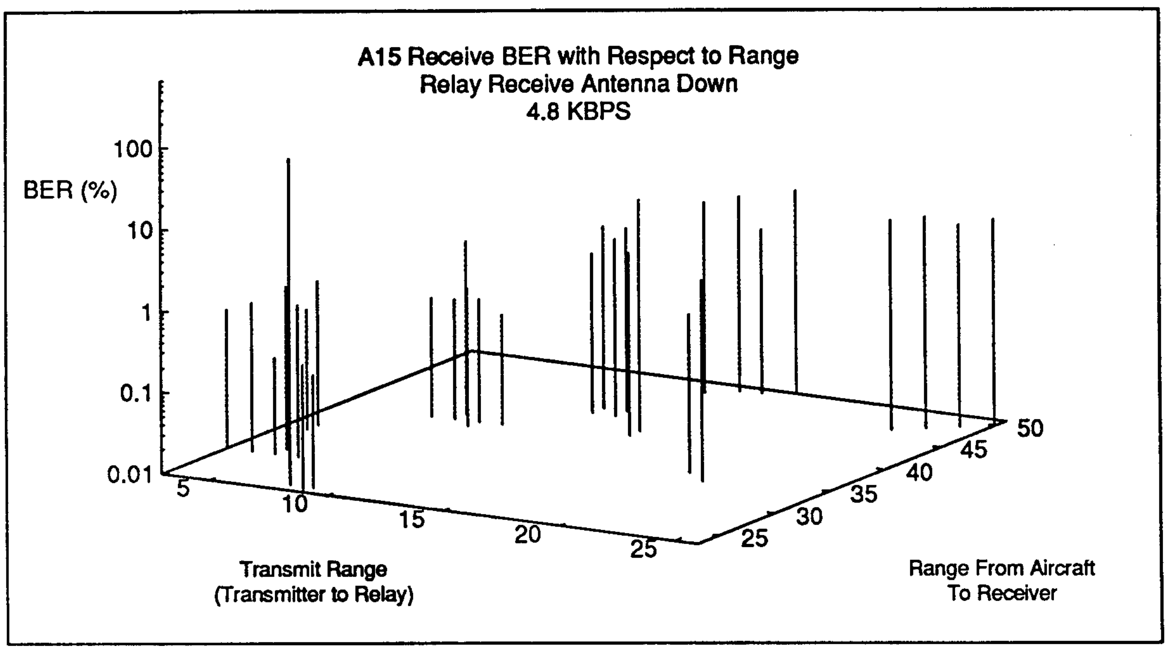

FIGURE 26

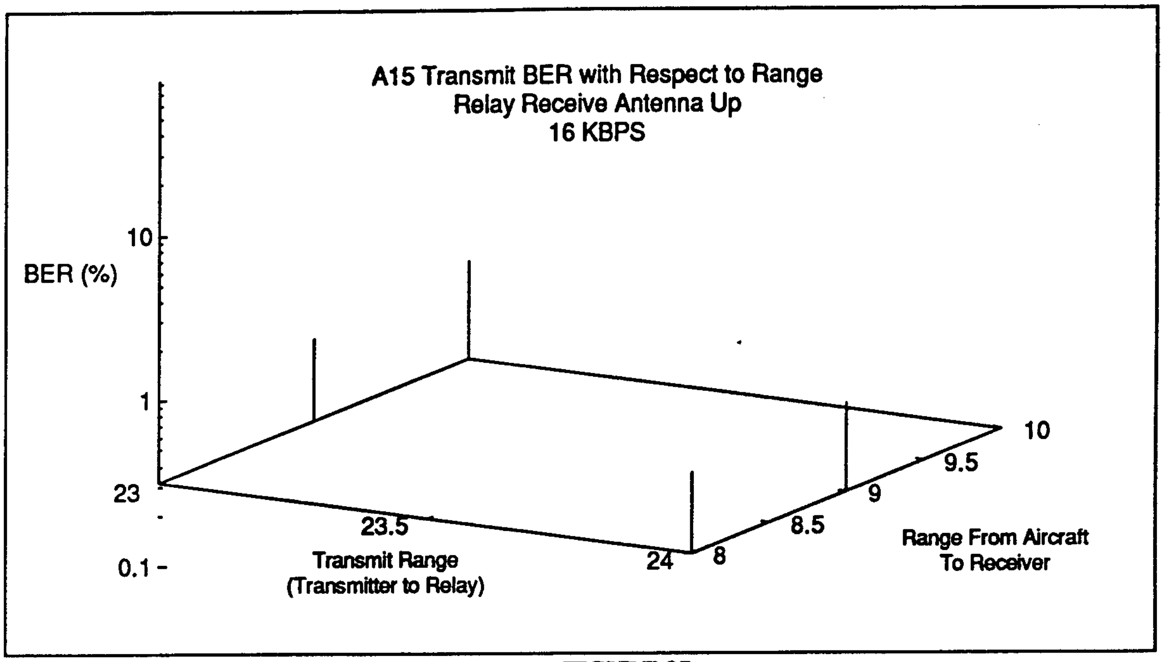

FIGURE 27

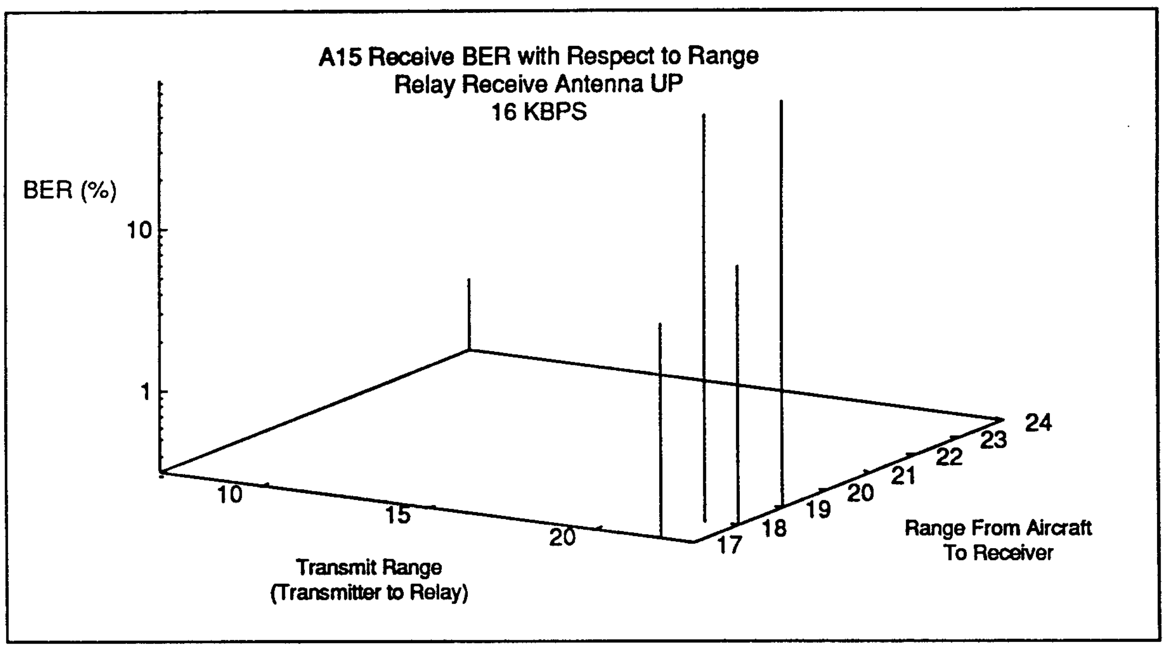

FIGURE 28

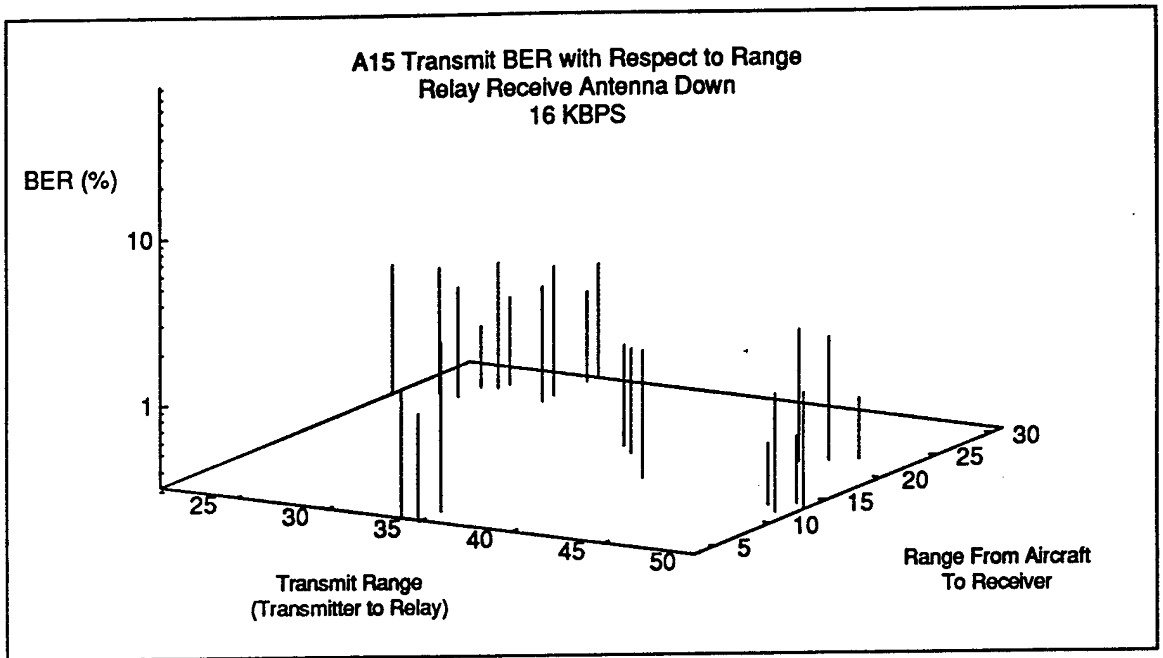

FIGURE 29

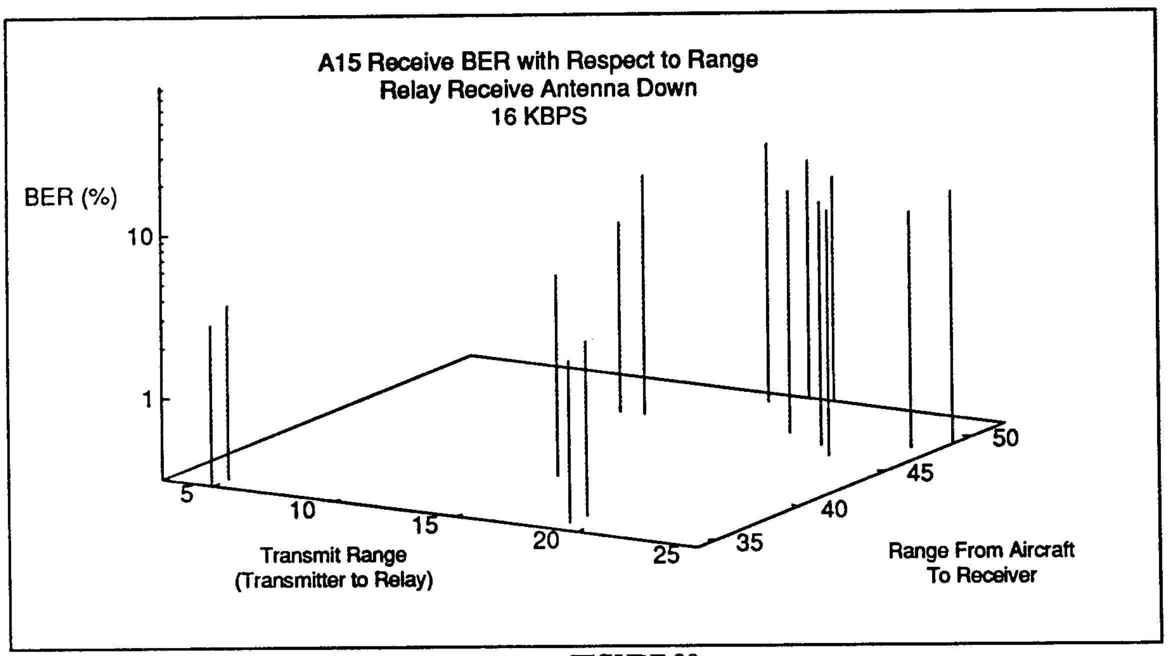

FIGURE 30

4.5 Conclusions

Using a manpack antenna on the shore site provides inadequate communications range transmitting data. Voice communication can be achieved at the 15 n-mile range with poor quality. Using a vehicular antenna on the shore site and the downward oriented receive antenna on the aircraft, the 4.8 KBPS data performance greatly exceeds the minimum range requirement. Also using 16 KBPS the unit will provide faster data communications than required while providing a link close to the minimum range requirement. With the receive antenna mounted in the upward orientation the system provides a 4.8 KBPS communications link which is so close to the minimum range requirement it cannot be conclusively shown that the link would be acceptable in all situations.

4.6 Recommendations

Relay antennas should be mounted in a manner that the receive antenna can be rotated to allow exposure beneath the airframe.

Shore antenna requirements should be investigated to see if the manpack or vehicular antenna is the expected shore communication station. If the manpack antenna is to be used and increased range performance is not gained through optimization of the interference cancellation unit (ICU) and through the use of the new ARC-201C radio units then data/range waivers need to be requested

5. <u>CERTIFICATIONS</u>

5.1 Certification of Test Results

The data presented above is an accurate representation of the data collected.

6. <u>APPENDICES</u>

Attached are the data sheets from the flight test.

Heading 1 - 315°
2 - 135°

(1)

Data Sheet Flight One

Date: 9/21/95
Site: A-15

Plain Text BER Data
1×10^{-2} (1%) is Passing

(MANPACK PWR ANT AT 30')

Range From A3	Time Z	16 KBPS Manpack	4.8 KBPS Manpack	16 KBPS AS-3900	4.8 KBPS AS-3900	A15 Receiving	A3 Receiving	Heading One	Heading Two
5NM	2148	X				LOSS SYNC NO LINK			X
5NM	2149	X				"			X
5NM	2152	X				RT SNYC NO BER TO HIGH		X	—
5NM	5153.	X				RT SNYC BER TO HIGH		X	
5NM	2155.28		X			RT SNYC NO BER TO HIGH			X
5NM	2156.42		X			RT SNYC BER 1790			X
5NM	2158.20		X			RT SNYC 1.07E-10^-1			X
5NM	2200.50		X			RT SNYC 9.36E 10^-2		X	
5NM	2201.50		X			RT SNYC 7X10^-2		X	
5NM	2202.33		X		X	RT SNYC 9X10^-2		X	
5NM	2208.42				X	NO SYNC w/AC		X	
5NM	2209.14				X	RT SYNC 2.3E-4		X	
	2209.50				X	RT SYNC 1X10^-4		X	
	2211.35				X	RT SYNC 1.83^-3			X
	2212.21				X	1.5E -4			X

Data Taken By: Edward [signature]

Verified By: Warren W. [signature]

Heading 1 -315
2 135

(2)

Data Sheet Flight One

Date: 9/21/95
Site: A-15

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

(MANPACK PWR ANT AT 30')

Range From A3	Time	16 KBPS Manpack	4.8 KBPS Manpack	~~16~~ 4.8 KBPS AS-3900	4.8 KBPS AS-3900	A15 Receiving	A3 Receiving	Heading One	Heading Two
5NM	2213.25			X		RT SYNC 3X10-3			X
	2213.51			X		RT SYNC 6X10-3			X
	2214.20			X		9 X 10-3			X
	2215.46			X		NO RTSNYC		X	
	2216.23			X		NO RTSNYC		X	
5NM	2216.56			X		RT SNYN NO DATA SNYC		X	
10NM	2221.48				X	RT SNYNC 3 X 10-3			X
10NM	2222.33				X	RTSNYN 2 X10-3			X
10NM	2224.01				X	RT SNYC 2 X10-3		X	
10NM	2224.42				X	NO RT SNYC		X	
10NM	2225.06				X	RT SNYC 4X10-3		X	
15NM	2241.24				X	RT SNYC NO DATA SNYC			X
	2241.46				X	RT SNYC NO DATA SNYC			X
	2242.08				X	RT SNYC 2 X 10-3			X
15NM	2242.45				X	RT SNYC 2X10-3			X

Data Taken By: Edward Keaing Jr. Verified By: Warren W. Dean

3

Heading 1 - 315
2 - 135

Data Sheet Flight One

Date: 9/21/95
Site: A-15

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

MANPACK PWR ANT 30'

Range From A3	Time	16 KBPS Manpack	4.8 KBPS Manpack	16 KBPS AS-3900	4.8 KBPS AS-3900	A15 Receiving	A3 Receiving	Heading One	Heading Two
15NM	2245.10				X	RT SNYC 2×10^{-3}		X	
15NM	2245.50				X	RT SNYC 3×10^{-3}		X	
20NM	2251.54				X	RT SNYC 2.04×10^{-3}			X
20NM	2252.50				X	RT SNYC 2.23×10^{-3}			X
20NM	22 53.25				X	RT SNYC 1.82×10^{-3}			X
20NM	2254.49				X	RT SNYC 5.57×10^{-3}		X	
20NM	2255.34				X	RT SNYC 3.99×10^{-3}		X	
25NM	2211.25				X	RT SNYC 4.3×10^{-3}		X	
25NM	2311.58				X	RT SNYC 4.62×10^{-3}		X	
25NM	2313.35				X	RT SNYC 3.21×10^{-3}			X
25NM	2314.12				X	RT SNYC 4.89×10^{-3}			X

Data Taken By: Edward [illegible]

Verified By: Warren W. [illegible]

Data Sheet Flight One

Date: 9/21/95
Site: A-15

BER / Aircraft Heading
AS-3900 Antennas at Site A15

Range 18NM

Time	Heading	16 KBPS	4.8 KBPS	Plain Text	Cypher Text
2318.45	360°	18NM 6.92×10^{-2}		X	
2318.58	360°	18NM 6.58×10^{-2}		X	
2321.10	180°	18NM LOSSING SNYC		X	
2321.25	180°	18NM 1.24×10^{-1}		X	
2321.43	180°	18NM 1.09×10^{-1}		X	
2322	180	18NM	18NM 3.3×10^{-2}	X	
2322.	090°	19NM 2.86×10^{-2}		X	
2323.56	090°	19NM 2.21×10^{-2}		X	
2324.23	090		19NM 1.70×10^{-3}	X	
2324.57	090		19NM 5.4×10^{-4}	X	
2325.12	270°	19.5NM 7.69×10^{-2}		X	
2326.41	270°	19.5NM BAD DATA		X	
2327.10	270°		19.5NM 1.44×10^{-2}	X	
2327.46	270		19.5NM 4.08×10^{-3}	X	

Data Taken By: Edward [illegible] Verified By: [illegible]

Data Sheet Flight One

Date: 9/12
Site: 4 2

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

Range From A3	Time	16 KBPS Manpack	4.8 KBPS Manpack	16 KBPS AS-3900	4.8 KBPS AS-3900	A15 Receiving	A3 Receiving	Heading One	Heading Two
.5	3/3/10	3410-2							135
✓		58V10-4							—
✓		20V [illegible] -4							✓
✓	39.19	41 -4							✓
✓	39.01	538V10-5							✓
✓	39.58	453V10-5							✓
—	4021	642V10-5							✓
✓	4518	342V10-5						[illegible]	
✓	4510	410V10-5						✓	
✓	4238	309 [illegible] -5						✓	
✓	4419	587V10-5						✓	
✓	4451	826V10-5						✓	
✓	4505	243V10-5						✓	

Data Taken By: [signature]

Verified By: [signature]

Data Sheet Flight One

Date: 9/12
Site: # 2

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

Range From A3	Time	16 KBPS Manpack	4.8 KBPS ~~Manpack~~ AS-3900	16 KBPS AS-3900	4.8 KBPS AS-3900	A15 Receiving	A3 Receiving	Heading One	Heading Two
10	22 2721		481x10-5						135
/	2809		456x10-5						✓
/	2947		461x10-5						✓
/	3040		439x10-5					315	
	3122		468x10-5					✓	
15	3627		458x10-5						135
	3735		11x10-4						✓
✓	3901		112x10-4					315	
/	3952		492x10-5					✓	
20	5701		470x10-5					315	
/	5854		472x10-5						135
/	23 0023		482x10-5						✓
/	0149		486x10-5					315	
25	0731		470x10-5						135
/	0817		11.5x10-5						

Data Taken By: Mark T. [illegible]

Verified By: Dale Murray

Data Sheet Flight One

Date: 9/12
Site: #2

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

Range From A3	Time	16 KBPS Manpack	4.8 KBPS Manpack	16 KBPS AS-3900	4.8 KBPS AS-3900	A15 Receiving	A3 Receiving	Heading One	Heading Two
25	231008				514X10-5			315	
	1056				547X10-5			–	

Data Taken By: [signature] Verified By: [signature]

D1A F300 Preset 3

Heading 1 = Ø3Ø°
2 = 2ØØ°

①

50 WATTS
Data Sheet Flight Two

Date: 9/22/95
Site: A-15

Plain Text BER Data
1×10^{-2} (1%) is Passing

	Range From A15	Time	16 KBPS AS3900	4.8 KBPS AS-3900	A15 Receiving	D1A Receiving	Heading One	Heading Two	
	25NM	1936.06	LOSS SNYC		x		x		
	25NM	1936.56	LOSS SNYC		x		x		
	25NM	1937.30	RT SNYC NO DATA SNYC		x		x		
	25NM	1938.14	RT SNYC NO DATA SNYC		x		x		
	25NM	1940.10	$8.63 \times 1Ø^{-3}$		x			x	
	25NM	1940.38	LOSS SNYC		x			x	
	25NM	1941.15	LOSS SNYC		x			x	
	25NM	1942.00		1.09×10^{-3}	x			x	
	25NM	1942.47		9.58×10^{-3}	x			x	
	25NM	1944.55		1.40×10^{-2}	x		x		
	25NM	1945.40		$1.Ø8 \times 10^{-2}$	x		x		
4W	25NM	1946.46		$1.05 \times 1Ø^{-2}$	x		x		
4W	25NM	1947.59		3.[illegible]3 $\times 1Ø^{-3}$	x		x		*over land, N-side
4W	25NM	1950.25		2.11×10^{-3}	x			x	
4W	25NM	1951.18		4.07×10^{-3}	x			x	over water

Data Taken By: Edward [signature]   Verified By: James W. [signature]

Heading 1 = 020°
2 = 200°

Data Sheet Flight Two

Date: 1/22/95
Site: A-15

Plain Text BER Data
1×10^{-2} (1%) is Passing

	Range From A15	Time	16 KBPS AS3900	4.8 KBPS AS-3900	A15 Receiving	D1A Receiving	Heading One	Heading Two	
50w	25NM	1952.27		1.12×10^{-2}	X			X	
50w	25NM	1953.07		6.99×10^{-3}	X			X	
50w	30NM	1958.44		3.36×10^{-3}	X		X		
	30NM	1959.28		5.19×10^{-3}	X		X		
	30NM	2000 34		7.11×10^{-3}	X		X		
	30NM	2001.42		1.38×10^{-2}	X		X	PARTLY	over land
50w	30NM	2002.34		3.26×10^{-3}	X		X		TOTAL OVER LAND
	30NM	2004.01		7.48×10^{-3}	X			X	over water
	30NM	2004.45		4.04×10^{-3}	X			X	
50w	30NM	2005.23		9.52×10^{-3}	X			X	
	35NM	2023 31		5.32×10^{-3}	X		X		
	35NM	2024.32		1.23×10^{-2}	X		X		
	|	2025.58		1.06×10^{-2}	X			X	
	|	2026.55		1.13×11^{-2}	X			X	water
50w	35NM	2027.38		1.15×10^{-2}	X			X	

Data Taken By: Edward [illegible] Jr

Verified By: Warren W. [illegible]

(2)

(3)

Heading 1 = 030°
2 = 300°

Data Sheet Flight Two

Date: 4/22/95
Site: A-15

Plain Text BER Data
1x10^{-2} (1%) is Passing

	Range From A15	Time	16 KBPS AS3900	4.8 KBPS A .-3900	A15 Receiving	D1A Receiving	Heading One	Heading Two	
50w	35NM	2028.22		1.01×10^{-2}	X			X	
	/	2030.40		9.35×10^{-3}	X		X		
	35NM	2031.27		1.05×10^{-2}	X		X		
	40NM	2036.40		9.96×10^{-3}	X		X		
		2037.37		5.58×10^{-3}	X		X		
		2038.10		8.11×10^{-3}	X		X		
		2039.43		2.34×10^{-3}	X			X	land
		2040.21		1.39×10^{-2}	X			X	water
		2041.02		1.67×10^{-2}	X			X	water
50w	40NM	2041.58		8.80×10^{-3}	X			X	
	45NM	2105.52		NOT Receiv'G	X		X		
	45NM	2106.22		9.80×10^{-3}	X		X		
	45NM	2107.12		2.71×10^{-2}	X		X		land
	45NM	2107:57		1.34×10^{-2}	X		X		
	45NM	10:02		NOT RCVNG	X			X	

Data Taken By: Edward Deaing Jr

Verified By: Warren W. Dlem

(4)

Data Sheet Flight Two

Heading 1 = 030°
2 = 200°

Date: 9/22/95
Site: A-15

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

50w

Range From A15	Time	16 KBPS AS3900	4.8 KBPS AS-3900	A15 Receiving	D1A Receiving	Heading One	Heading Two
45NM	21 10.40		7.23×10^{-3}	X			X
45NM	21 11.11		1.54×10^{-2}	X			X
45NM	21 11.58		1.34×10^{-2}	X			X

Data Taken By: Edward Heaing Jr. Verified By: Warren W. Dean

Hwy 5 MIS off Shore (1)

Data Sheet Flight One

A-15 TRANSMITTING

"Z" TIME

Date: 9/22/95
Site: A-15

BER / Aircraft Heading
AS-3900 Antennas at Site A15 & D1A

D1A Receiving

Time	Heading	16 KBPS	4.8 KBPS	Plain Text	Cypher Text
21 17.25	Ø45°		514×10^{-5}	X	
21 17.58	Ø45°		531×10^{-5}	X	
21 20.05	315°		554×10^{-5}	X	
21 20.46	315°		518×10^{-5}	X	
21 22.21	225°		813×10^{-5}		X
21 23.06	225°		NO RCVNG	X	
21 23.30	225°		1194×10^{-5}	X	
21 24.32	225°		1120×10^{-5}	X	
21 25.59	135°		NO SNYC	X	
21 26.37	135°		OVERLOAD	X	
21 26.57	135°		217×10^{-4}	X	

Data Taken By: Edward Nearing Jr. Verified By: James W. Dean

Data Sheet Flight Two

Date: 9/22/95
Site: D/A

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

Range From A15	Time	16 KBPS AS3900	4.8 KBPS AS-3900	A15 Receiving	D1A Receiving	Heading One	Heading Two
25	192927	989×10^{-5}				20	
	3220	975×10^{-5}					200
	3301	1081×10^{-5}					X
	3522	1240×10^{-5}				X	
30	200637		557×10^{-5}				X
	200722		548×10^{-5}				X
	0758		580×10^{-5}				X
	0950		466×10^{-5}			20	
	1030		451×10^{-5}			X	
	1100		[illegible]			X	
35	1640		737×10^{-5}				X
	1801		574×10^{-5}				X
	1842		685×10^{-5}				X
	2030		464×10^{-5}			20	
	2100		462×10^{-5}			X	

Data Taken By: Willy L. Lewis Verified By: [illegible]

Data Sheet Flight Two

Date: 9/22/95
Site: D1A

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

Range From A15	Time	16 KBPS AS3900	4.8 KBPS AS-3900	A15 Receiving	D1A Receiving	Heading One	Heading Two
35	202150		448×10^{-5}			20	
40	4307		834×10^{-5}				200
	4400		831×10^{-5}				X
	4445		979×10^{-5}				X
	4652		463×10^{-5}			20	
	4733		472×10^{-5}			X	
	4809		472×10^{-5}			X	
	4917		477×10^{-5}			X	
	5126		737×10^{-5}			X	
	5355		700×10^{-5}				200
45	5834		1094×10^{-5}				X
	5929		1190×10^{-5}				X
	210012		1044×10^{-5}				X
	0121		1210×10^{-5}				X
	0339		524×10^{-5}			20	

Data Taken By: Willy L. Legion Verified By: J. Morine

Data Sheet Flight Two

Date: 9/22/95
Site: D1A

Plain Text BER Data
1x10^{-2} (1%) is Passing

Range From A15	Time	16 KBPS AS3900	4.8 KBPS AS-3900	A15 Receiving	D1A Receiving	Heading One	Heading Two
45	210420		532×10^{-5}			20	
	0457		549×10^{-5}			X	
	1721		514×10^{-5}			045	
	1755		531×10^{-5}			X	
	2012		554×10^{-5}			315	
	2046		518×10^{-5}			X	
	2140		1075×10^{-5}			X	
	2232		813×10^{-5}			225	
	2327		1194×10^{-5}			225	
	2449		1120×10^{-5}			225	
	2706		217×10^{-4}			135	

TURN CT

Data Taken By: Willy [illegible]   Verified By: [illegible signature]

5 USING RADIO #2

HEADING 1 = 020°
Z = 200°

D1A PRESET 3
A15 " Z

(1)

Data Sheet Flight 3

Date: 9/25/95
Site: A-15

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

Range From A15	Time	16 KBPS AS3900	4.8 KBPS AS-3900	A15 Receiving	D1A Receiving	Heading One	Heading Two	
25NM	1522.24		Unit in CTvicP	NO RCV			X	RADIO B
25 NM	1523.18		8.27×10^{-3}	X			X	
25NM	1524.05		2.36×10^{-3}	X			X	
25NM	1524.43		3.60×10^{-3}	X			X	
	1526.25		2.14×10^{-3}	X		X		
	1526.58		1.36×10^{-3}	X		X		
25NM	1527.37		1.75×10^{-3}	X		X		
30NM	1548.25		5.8×10^{-4}	X			X	Radio B
	1549.01		4.86×10^{-3}	X			X	" B
	1549.37		6.55×10^{-3}	X			X	" B
	1550.26		1.53×10^{-3}				X	Radio A
	1551.02		7.21×10^{-3}	X			X	" A
	1552.41		1.28×10^{-3}	X		X		"
30NM	1553.14		9.70×10^{-3}	X		X		"
35NM	1558.13	2.84×10^{-2}					X	

Data Taken By: Edward Wearing Jr

Verified By: Warren W. Klem

HEADING 1 = 020°
2 = 200°

(2)

Data Sheet Flight 3

Date: 4/25/95
Site: A-15

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

Range From A15	Time	16 KBPS AS3900	4.8 KBPS AS-3900	A15 Receiving	D1A Receiving	Heading One	Heading Two	
35NM	1558.50	3.64×10^{-2}		X			X	Radio A
	1559.14		2.40×10^{-3}	X			X	
	1559.54		2.92×10^{-3}	X			X	
	1601.38	3.04×10^{-2}		X		X		
	1602.01	3.62×10^{-2}		X		X		
	1602.36		3.64×10^{-3}	X		X		
35NM	1603.16		5.71×10^{-3}	X		X		
40NM	1620.15		1.33×10^{-2}	X		X		Land
	1621.35		2.8[illegible] $\times 10^{-3}$	X			X	
	1622.10		2.42×10^{-3}	X			X	Land
	1622.56		2.44×10^{-3}	X			X	* water
	1624.48		4.95×10^{-3}	X			X	Water
	1625.05		2.44×10^{-3}	X			X	
	1625.36		2.39×10^{-3}	X			X	
40NM	1627.09		2.15×10^{-3}	X		X		Water

Data Taken By: Edward Wearing Jr. Verified By: Warren W. Dean

HEADING 1 - 20°
2 - 200°

(3)

Data Sheet Flight 3

Date: 9/25/95
Site: A-15

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

Range From A15	Time	16 KBPS AS3900	4.8 KBPS AS-3900	A15 Receiving	D1A Receiving	Heading One	Heading Two
40NM	1628.06		3.21×10^{-3}	X		X	
45NM	1645.02		8.28×10^{-3}	X			X
	1645.30		8.85×10^{-3}	X			X
	1646.02		9.11×10^{-3}	X			X
	1647.40		1.47×10^{-2}	X		X	
	1648.17		1.82×10^{-2}	X		X	
45NM	1649.00		1.73×10^{-2}	X		X	

CT

Data Taken By: Edward Dearing Jr

Verified By: Warren W. De...

(1)

Data Sheet Flight 3

XMTR

BER / Aircraft Heading

Date: 9/25/95
Site: 4-13

(1) **A15 Antenna AS3900**
(2) **D1A Antenna AS3900**

	Time	Heading	16 KBPS	4.8 KBPS	Plain Text	Cypher Text	
2	1631.45	Ø85°		1.69×10^{-2}	X		43 NM
2	1632.13	Ø85°		1.97×10^{-7}	X		43 NM
1	16 53.10	180°		704×10^{-5}	X		
1	16 53.30	180°		521×10^{-5}	X		
1	16 53.52	180°		284×10^{-5}		X	
1	16 55.13	270°		687×10^{-5}	X		
1	16 55.45	270°		580×10^{-5}	X		
1	16 56.30	270°		584×10^{-5}		X	
1	16 58.04	090°		NOT RCVING	X		
1	16 58.24	090°		464×10^{-5}	X		
1	16 59.03	090°		565×10^{-5}	X		
1	16 59.41	090°		334×10^{-5}		X	
1	17 00.50	000°		45.5×10^{-5}	X		
1	1701.21	000°		489×10^{-5}	X		
	1701.59	000°		222×10^{-5}		X	

Data Taken By: Edward Wearing Jr. Verified By: Warren W. Glen

②

Data Sheet Flight 3

Date: 9/25/95

Site: A-15

BER / Aircraft Heading

1 **A15 Antenna AS3900**

2 **D1A Antenna AS3900**

	Time	Heading	16 KBPS	4.8 KBPS	Plain Text	Cypher Text
1	1704.02	225°		670×10^{-5}	X	
1	1704.52	225°		NOT RCVING	X	
1	1705.18	225°		693×10^{-5}	X	
1	1706.02	225°		492×10^{-5}		X
1	1707.43	135°		501×10^{-5}	X	
1	1708.37	135°		695×10^{-5}	X	
1	1709.03	135°		258×10^{-5}		X
1	1710.18	045°		474×10^{-5}	X	
1	1710.50	045		653×10^{-5}	X	
1	1711.26	045		402×10^{-5}		X
	1712.29	315°		NOTRCVNG	X	
	1712.45	315°		665×10^{-5}	X	
	1713.17	315°		797×10^{-5}	X	
	1713.45	315°		487×10^{-5}		X
	—	—	—	—	—	—

Data Taken By: Edward Dearing Jr. Verified By: Warren W. Dean

Data Sheet Flight #3

Date: 9-25-95
Site: D1A

Plain Text BER Data
1x10^{-2} (1%) is Passing

Range From A15	Time	16 KBPS AS3900	4.8 KBPS AS-3900	A15 Receiving	D1A Receiving	Heading One	Heading Two
25nm	10:23:43		2.27×10^{-3}	✓			✓
	10:24:30		2.36×10^{-3}	✓			✓
	10:25:08		3.60×10^{-3}	✓			✓
	10:26:30		2.14×10^{-3}	✓		✓	
	[illegible]:28		1.36×10^{-7}	✓		✓	
	10:28:00		1.75×10^{-3}	✓		✓	
	10:29:08		716×10^{-5}		✓	✓	
	10:29:44		861×10^{-5}		✓	✓	
	[illegible]31:05		674×10^{-5}		✓		✓
	10:31:43		747×10^{-5}		✓		✓
	10:32:20		672×10^{-5}		✓		✓
	10:34:[illegible]		671×10^{-5}		✓	✓	
	10:34:35		624×10^{-5}		✓	✓	
30nm	10:39:36		1642×10^{-5}		✓		✓
	10:40:37		1648×10^{-5}		✓		✓

Data Taken By: [signature]

Verified By: [signature]

Data Sheet Flight #3

Date: 7-25-95
Site: [illegible]

Plain Text BER Data
1×10^{-2} (1%) is Passing

Range From A15	Time	16 KBPS AS3900	4.8 KBPS AS-3900	A15 Receiving	D1A Receiving	Heading One	Heading Two
30 nm	10:41:45		478×10^{-5}		✓		✓
	10:42:25		459×10^{-5}		✓		✓
	10:44:05		506×10^{-5}		✓	✓	
	10:44:38		525×10^{-5}		✓	✓	
	10:45:16		554×10^{-5}		✓	✓	
	10:4[illegible]:53		14[illegible] $\times10^{-5}$		✓	✓	
	10:46:23		1493×10^{-5}		✓	✓	
	10:48:55		5.8×10^{-4}	✓			✓
	10:49:30		486 ×10[illegible]	✓			✓
	10:50:[illegible]		6.55 ×10[illegible]	✓			✓
	10:5[illegible]:00		1.53×10^{-3}	✓			✓
	10:51:30		7.21×10^{-3}	✓			✓
	10:52:00		1.28×10^{-3}	✓		✓	
	10:53:45		9.7×10^{-4}	✓		✓	
5 nm	10:58:30	1.84×10^{-2}		✓			✓

Data Taken By: [signature] Verified By: [signature]

Data Sheet Flight #3

Date: [illegible]
Site: D1A

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

Range From A15	Time	16 KBPS AS3900	4.8 KBPS AS-3900	A15 Receiving	D1A Receiving	Heading One	Heading Two
25 [illegible]	[illegible]	[illegible]		✓			✓
	10:[illegible] 45		$2.46 \times 10^{-?}$	✓			✓
	[illegible]:00:20		2.12×10^{-3}	✓			
	11:[illegible]	3.204×10^{-2}		✓		✓	
	[illegible] 02 [illegible]	3.62×10^{-2}		✓		✓	
	11 03 [illegible]		[illegible] $\times 10^{-3}$	✓		✓	
	11 [illegible]		[illegible] $\times 10^{-3}$	✓		✓	
	11 05:[illegible]	141×10^{-4}			✓		✓
	[illegible] 05 44	$[illegible]12 \times 10^{-5}$			✓		✓
	11 [illegible] 30		494×10^{-5}		✓		✓
	11 07 02		460×10^{-5}		✓		✓
	11 [illegible] 05	255×10^{-4}			✓	✓	
	[illegible] 09:22	$3[illegible] \times 10^{-4}$			✓	✓	
	11 10:[illegible]		[illegible] $\times 10^{-5}$		✓	✓	
	11 [illegible]		[illegible] 7×10^{-5}		✓	✓	

VERY NOISY

Data Taken By: [illegible]

Verified By: [illegible]

Data Sheet Flight [illegible]

Date: [illegible]
Site: [illegible]

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

Range From A15	Time	16 KBPS AS3900	4.8 KBPS AS-3900	A15 Receiving	D1A Receiving	Heading One	Heading Two
	11:16:10		$5/1 \times 10^{-5}$		✓		✓
	11:17:30		544×10^{-5}		✓		✓
	[illegible]:24		524×10^{-5}		✓		✓
	[illegible]:08		658×10^{-5}		✓	✓	
	11:[illegible]:40		650×10^{-5}		✓	✓	
	11:20:40		1.33×10^{-2}	✓		✓	
	11:22:00		2.80×10^{-3}	✓			✓
	11:22:45		2.42×10^{-3}	✓			✓
	[illegible]		4.95×10^{-3}	✓			✓
	11:25:25		2.44×10^{-3}	✓			✓
	[illegible]		[illegible]	✓			✓
	[illegible]:27:[illegible]		2.15×10^{-3}	✓		✓	
	[illegible]:30		3.21×10^{-3}	✓		✓	
45nmi	11:34:50		$[illegible] \times 10^{-5}$		✓		✓
|	11:35:20		$[illegible] \times 10^{-5}$		✓		✓

Data Taken By: [illegible]

Verified By: [illegible]

Data Sheet Flight [illegible]

Date: [illegible]-25-95
Site: D1A

Plain Text BER Data
1x10^{-2} (1%) is Passing

Range From A15	Time	16 KBPS AS3900	4.8 KBPS AS-3900	A15 Receiving	D1A Receiving	Heading One	Heading Two
~5 [illegible]	11 4[illegible]		5.24×10^{-5}		✓	✓	
	11:4[illegible]		4.02 x[illegible]		✓	✓	
	11 4[illegible]:36		[illegible]		✓	✓	
	11:43:30		2.8[illegible]		✓	✓	
	11 4[illegible]		8.[illegible]	✓			✓
	11 4[illegible]		8.5[illegible] $\times 10^{-3}$	✓			✓
	11:46:35		1.1[illegible] $\times 10^{-3}$	✓			✓
	11:4[illegible]		1.47 x[illegible]	✓		✓	
	11 49:10		1.82 x[illegible]	✓		✓	
	[illegible]		3.[illegible]	✓		✓	

Data Taken By: [illegible]

Verified By: [illegible signature]

Data Sheet Flight #3

Date: 9-25-95
Site: DIA

BER / Aircraft Heading

A15 Antenna AS3900
D1A Antenna AS3900

Time	Heading	16 KBPS	4.8 KBPS	Plain Text	Cypher Text
11:53:[illegible]	[illegible]		[illegible] $\times 10^{-5}$	✓	
11:[illegible]:40	|		521×10^{-5}	✓	
11:54:20	|		284×10^{-5}		✓
11:55:35	270°		687×10^{-5}	✓	
11:56:05	|		580×10^{-5}	✓	
11:56:55	|		324×10^{-5}		✓
[illegible]	90°		464×10^{-5}	✓	
[illegible]	|		[illegible]	✓	
12:00:05	|		334×10^{-5}		✓
12:[illegible]:12	0°		485×10^{-5}	✓	
12:01:47	|		489×10^{-5}	✓	
12:02:21	|		222×10^{-5}		✓
[illegible]:25	225°		670×10^{-5}	✓	
12:05:41	|		693×10^{-5}	✓	
12:[illegible]	|		492×10^{-5}		✓

Data Taken By: [illegible]
Verified By: [illegible signature]

Data Sheet Flight #2

Date: 9-25-95
Site: [illegible]

BER / Aircraft Heading

A15 Antenna AS3900
D1A Antenna AS3900

Time	Heading	16 KBPS	4.8 KBPS	Plain Text	Cypher Text
12:08:20	135°		501×10^{-5}	✓	
12:[illegible]	|		615×10^{-5}	✓	
12:[illegible]:34	|		252×10^{-5}		✓
12:10:[illegible]	45°		474×10^{-5}	✓	
12:11:14	|		653×10^{-5}	✓	
12:11:48	|		$40? \times 10^{-5}$		✓
12:[illegible]	315°		665×10^{-5}	✓	
12:13:40	|		797×10^{-5}	✓	
12:14:[illegible]	|		487×10^{-5}		✓

Data Taken By: [illegible signature] Verified By: [illegible signature]

25 Nmi A3

Data Sheet Flight 4

21.5 Nmi: A15

Date: 9/27/95
Site:

BER / Aircraft Heading

A15 Antenna AS3900
D1A Antenna AS3900

	Time	Heading	16 KBPS	4.8 KBPS	Plain Text	Cypher Text
	20:31:06	180	$1,868 \times 10^{-5}$		✓	
	20:36:12	[redacted] 090	$1,543 \times 10^{-5}$			✓
	20:36:39	090	$1,823 \times 10^{-5}$		✓	
	20:37:06	090	764×10^{-5}		✓	
1G HIGH PWR	20:38:08	090		283×10^{-5}	✓	
	20:39:36	090		1773×10^{-5}		✓
HI-PWR	20:40:15	090		NDS		✓
PA	20:41:40	360		$1,876 \times 10^{-5}$		✓
HI-PWR	20:42:28	360		NDS		✓
HI-PWR	20:43:25	360		5×10^{-5}		✓
"	20:44:00	360		0×10^{-5}		✓
"	20:44:30	360		278×10^{-5}	✓	
PA	20:45:06	360		[redacted] 1,788	✓	
HI-PWR	20:46:03	360		733	✓	
"	20:46:20	360		509		✓

Data Taken By: James M. Kerr

Verified By: Renee Shezogue

Data Sheet Flight 4

25 Nmi, A3
21.5 Nmi A15

Date: 9/27/95
Site:

BER / Aircraft Heading

A15 Antenna AS3900
D1A Antenna AS3900

	Time	Heading	16 KBPS	4.8 KBPS	Plain Text	Cypher Text
PA	20:46:42	360	1,424	[redacted]		✓
1-PWR	20:47:59	270	804		✓	
11-PWR	20:48:30	270	617			✓
PA	20:48:49	270	1,799			✓
1-PWR	20:49:23	270	[redacted]	5		✓
PA	20:50:06	270		1,822		✓
PA	20:50:45	270		1,986	✓	
1-PWR	20:51:26	270		296	✓	
1-PWR	20:53:44	045		272	✓	
11-PWR	20:54:56	045		15		✓
" "	20:56:00	045	402	.		✓
" "	20:56:23	045	702		✓	
" "	20:58:49	135	903		✓	
" "	20:59:24	135	763			✓
" "	20:59:51	135		25		✓

Data Taken By: James W. Key Verified By: Renee Shezo

25 Nmi A3
21.5 Nmi A15

Data Sheet Flight ~~4~~

Date: 9/27/95
Site:

BER / Aircraft Heading

A15 Antenna AS3900
D1A Antenna AS3900

	Time	Heading	16 KBPS	4.8 KBPS	Plain Text	Cypher Text
PWR	21:00:34	[redacted] 135		248	✓	
"	21:02:25	225		262	✓	
"	21:03:05	225		23		✓
" "	21:03:45	225	915			✓
" "	21:04:18	225	1095		✓	
" "	21:06:00	315	1526		✓	
" "	21:06:26	315	942			✓
" "	21:06:56	315		19		✓
" "	21:07:37	315		260	✓	
" "	21:16:05	180		263	✓	
" "	21:17:08	180		15		✓
" "	21:17:51	180	728			✓
" "	21:18:22	180	1070		✓	
		090				

Data Taken By: [signature]   Verified By: [signature]

Data Sheet Flight ~~One~~ Four

Date: 9/27/95
Site:

Antenna	
Manpack	
AS3900	✓

DCT Communication
4.8 KBPS Data Rate

	Range	Time	Message Received	Reply Received	Sending Site A3	Sending Site A15	Heading 1	Heading 2	Mode PT	Mode CT
16K	29 NMi A3	21:22:50	✓		✓		090		✓	
16K		21:23:30	✓		✓		090		✓	
4.8		21:24:18	[redacted] ✓	✓	✓ [redacted]	[redacted]	090		✓	
4.8		21:24:53	✓	✓		✓	090		✓	
~~4.8~~		~~21:25:14~~				✓	~~090~~			
16K		21:26:26	✓			✓	090		✓	
16K		21:28:15	✓		✓		360		✓	
16K		21:29:20	✓	✓	✓		360			✓
16K		21:30:02	✓	✓		✓	360			✓
16K		21:31:04	✓			✓	360		✓	
16K		21:32:41			✓		270		✓	
16K		21:33:12			✓		270		✓	
16K		21:33:56			✓		270			✓
4.8		21:34:25	✓		✓		270			✓

Data Taken By: James W. King

Verified By: [signature]

Data Sheet Flight ~~One~~ Four

Date: 9/27/95
Site:

Antenna	
Manpack	
AS3900	✓

DCT Communication
4.8 KBPS Data Rate

	Range	Time	Message Received	Reply Received	Sending Site A3	Sending Site A15	Heading 1	Heading 2	Mode PT	Mode CT
4.8	29NMi A3.	21:35:05	✓	✓	✓		270			✓
4.8		21:36:02	✓	✓		✓	270		✓	
16K		21:37:31	✓			✓	045		✓	
16K		21:38:10	✓	✓		✓	045			✓
4.8		21:38:48	✓	✓		✓	045			✓
4.8		21:39:33	✓	✓		✓	045		✓	
4.8		21:40:12	✓	✓	✓		045		✓	
16K		21:41:42			✓		315			✓
16K		21:42:19	✓	✓	✓		315			✓
16K		21:43:11	✓		✓		315		✓	
4.8		21:44:09	✓	✓		✓	315		✓	
16K		21:45:23	✓			✓	225		✓	
16K		21:46:02	✓			✓	225			✓
4.8		21:47:22	✓			✓	225			✓

Data Taken By: James W. Kay Verified By: [illegible]

1-2

Data Sheet Flight ~~One~~ FOUR

Date: 5/22/95
Site:

Antenna	
Manpack	
AS3900	✓

DCT Communication
4.8 KBPS Data Rate

	Range	Time	Message Received	Reply Received	Sending Site A3	Sending Site A15	Heading 1	Heading 2	Mode PT	Mode CT
4.4	29 Nmi A3	21:48:20			✓		225			✓
16K	← INVALID →	21:49:43			✓		135			✓
16K		21:51:46			✓	[redacted]	135			✓
16K		21:52:56	✓			✓	020			✓
4.8		21:53:34	✓		✓		020			✓
4.8		21:54:09	✓		✓		020			✓
4.8		21:55:03			✓	[redacted]	020			✓

Data Taken By: James W. Key

Verified By: Ronnie Sheppard

Data Sheet Flight #4

Date: 9-27-95
Site A3

Voice Communication Data Sheet

		Voice Quality						Mode	
		Signal			Audio				
Range	Time	Strong	Weak	Broken	Good	Readable	Poor	PT	CT
	16:56:30	✓				✓			✓
	16:58:30	✓				✓			✓

Data Taken By: [illegible]
Verified By: Warren W. [illegible]

Data Sheet Flight #4

Date: 9-27-95
Site: A3

Antenna
AS3900

DCT Communication

~~4.8 KBPS Data Rate~~

Range	Time	Message Received	Reply Received	Sending Site		Heading		Mode		DATA RATE (KBPS)
				A3	A15	1	2	PT	CT	
29 nmi	16:34:02	NO		✓		270°			✓	16
	16:34:30	✓	NO	✓					✓	4.8
	16:35:10	✓	✓	✓					✓	
	16:36:02	✓	✓		✓			✓		
	16:37:31	✓	NO		✓	45°		✓		16
	16:38:20	✓	✓		✓				✓	
	16:38:55	✓	✓		✓				✓	4.8
	16:39:34	✓	✓		✓			✓		
	16:40:13	✓	✓	✓				✓		
	16:41:40	NO		✓		315			✓	16
	16:42:20	✓	✓	✓					✓	

Data Taken By: ____________________

Verified By: Warren W. [signature]

Data Sheet Flight #4

Date: 9.27.95
Site: A3

Antenna
AS3900

DCT Communication

~~4.8 KBPS Data Rate~~

Range	Time	Message Received	Reply Received	Sending Site A3	Sending Site A15	Heading 1	Heading 2	Mode PT	Mode CT	DATA RATE (KBPS)
29 nm.	16:43:12	✓	NO	✓		315°		✓		16
	16:44:09	✓	✓		✓	|		✓		4.8
	16:45:24	✓	NO		✓	225°		✓		16
	16:46:00	✓	NO		✓	|			✓	|
	16:47:20	✓	NO		✓	|			✓	4.8
	16:48:22	NO		✓		|			✓	|
*	16:49:45	NO		✓		135°			✓	16
	16:51:45	NO		✓		|			✓	| 30 nm.
	16:53:00	✓	NO		✓	20°			✓	|
	16:53:38	✓	NO		✓	|			✓	4.8
	16:54:12	✓	NO		✓	|			✓	|

Data Taken By: ______________________ Verified By: J.O. Moroney, Warren W. Dler.

* WRONG DATA RATE SETTING

Data Sheet Flight #4

Date: 9-27-95
Site: A3

Antenna	
Manpack	
AS3900	

DCT Communication
~~4.8 KBPS Data Rate~~

Range	Time	Message Received	Reply Received	Sending Site		Heading		Mode		DATA RATE (KBPS)
				A3	A15	1	2	PT	CT	
29 km	16:55:00	NC		✓		20°			✓	4.8 NOISY ENVIRON

Data Taken By: ______________ Verified By: Warren W. Den.

Data Sheet Flight #4

Date: 9-27-95
Site: A3

Antenna
AS3900

DCT Communication

~~4.8 KBPS Data Rate~~

Range	Time	Message Received	Reply Received	Sending Site		Heading		Mode		DATA RATE (KBPS)
				A3	A15	1	2	PT	CT	
29 nmi	16:22:50	✓	NO	✓		90°		✓		16
|	16:23:25	✓	NO	✓		|		✓		|
|	16:24:17	✓	✓	✓		|		✓		4.8
|	16:25:10	✓	✓		✓	|		✓		|
|	16:26:26	✓	NO		✓	|		✓		16
|	16:28:14	✓	NO	✓		360°		✓		|
|	16:29:24	✓	✓	✓		|			✓	|
|	16:30:02	✓	✓		✓	|			✓	|
|	16:31:06	✓	NO		✓	|		✓		|
|	16:32:42	NO		✓		270°		✓		[illegible]
|	16:33:15	NO		✓		|		✓		|

Data Taken By: ______________________ Verified By: [illegible]

Data Sheet Flight #4

Date: 9-27-95
Site: A3

BER / Aircraft Heading

A15 Antenna AS3900
A3 ~~D1A~~ Antenna AS3900

XMT.

Time	Heading	16 KBPS	4.8 KBPS	Plain Text	Cypher Text
15:31 27	180°	1868×10^{-5}		✓	
15:36.18	90°	1543×10^{-5}			✓
15:36:40		1823×10^{-5}		✓	
15:37 10		764×10^{-5}		✓	
15:38:25			283×10^{-5}	✓	
15:39:			No RCV.		✓
15 39 54			1773×10^{-5}		✓
15 40					✓
15 41.59	360°		1876×10^{-5}		✓
15:43:40			5×10^{-5}		✓
15:44:10			0×10^{-5}		✓
15:44:49			278×10^{-5}	✓	
15:45:30			1788×10^{-5}	✓	
15:46:05		733×10^{-5}		✓	
15:46:21		509×10^{-5}			✓

PA
HI
PA
HI
PA
HI

A15

RANGE
25 n.m.
(21.5 nm @ A15)

27 nm.

Data Taken By:

Verified By: [signature]

Data Sheet Flight #4

Date: 9-27-95
Site: A3

BER / Aircraft Heading

A15 Antenna AS3900
A3 **~~D1A~~ Antenna AS3900**

XMT A15

Time	Heading	16 KBPS	4.8 KBPS	Plain Text	Cypher Text
15 46 46	360°	1424×10^{-5}			✓
15:48:08	270°	804×10^{-5}		✓	
15:48:29	|	617×10^{-5}			✓
15 48 55	|	1799×10^{-5}			✓
15 49.29	|		5×10^{-5}		✓
15:50:25	|		1822×10^{-5}		✓
15:51:05	|		1986×10^{-5}	✓	
15:51:40	|		296×10^{-5}	✓	
15:53:59	45°		272×10^{-5}	✓	
15:54.50	|		15×10^{-5}		✓
15:56:06	|	402×10^{-5}			✓
15:56:30	|	702×10^{-5}		✓	
15:58:58	135°	903×10^{-5}		✓	
15:59:30	|	763×10^{-5}			✓
16:00:14	|	~~25×10~~	25×10^{-5}		✓

R: H1 PA H1

← 2x....

Data Taken By: ______________________ Verified By: [signature]

Data Sheet Flight # 4

Late: 9-27-95

Site: A3

BER / Aircraft Heading

A15 Antenna AS3900

A3 **~~D1A~~ Antenna AS3900**

Time	Heading	16 KBPS	4.8 KBPS	Plain Text	Cypher Text
16:00:56	135°		248×10^{-5}	✓	
16:02:44	225°		262×10^{-5}	✓	
16:03:27			23×10^{-5}		✓
16:03:51		915×10^{-5}			✓
16:04:24		1095×10^{-5}		✓	
16:06:02	315°	1526×10^{-5}		✓	
16:06:34		942×10^{-5}			✓
16:07:15			19×10^{-5}		✓
16:07:58			260×10^{-5}	✓	
16:16:25	180°		263×10^{-5}	✓	
16:17:32			15×10^{-5}		✓
16:17:57		728×10^{-5}			✓
16:18:30		1070×10^{-5}		✓	

HI

Xmt / A15

← 30 nmi

Data Taken By:

Verified By: [signature]

A 15 -> A3

Data Sheet Flight 4
Pre flight

Date: 9/27/95
Site: A15

Plain Text BER Data
1x10^{-2} (1%) is Passing

Battery | Power supply

Range From A3	Time	16 KBPS Manpack	4.8 KBPS Manpack	16 KBPS AS-3900	4.8 KBPS AS-3900	A15 Receiving	A3 Receiving	Heading One	Heading Two
21 Top	Hi								
	Low								
	med								
22 Bot	Hi	313 -5	167 -5						
	Low	NS							
	med	482 -5	180 -5						
	PA	366 -5	164 -5						
22	Top Hi								
	Low								
	Med								
21 Bot	H								
	L								
	m								

PA

Data Taken By: Warren W. Ike. Verified By:

A3 -> A15

Data Sheet Flight 4
Preflight

Date: 9/27/95
Site: A15

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

Power Supply Battery

Range From A3	Time	16 KBPS Manpack	4.8 KBPS Manpack	16 KBPS AS-3900	4.8 KBPS AS-3900	A15 Receiving	A3 Receiving	Heading One	Heading Two
RTA	H	3.58 -3	No Data	5.77×10^{-3}					
	m	4.16 -2		2.69×10^{-2}					
	L	N/RT							
	PA	No Data Sync	~~No Data~~	NDS					
				2.29×10^{-3}					
	H		1.4E -4	3 ~~x10~~ -5	3×10^{-5}				
	m		2.69 -3	~~3.20~~ -3	3.2×10^{-3}				
	L								
	PA		7.74 -3		0 x 10^{-5}				

Data Taken By: Warren W. [illegible]

Verified By:

PREFLIGHT – ...

~~Data Sheet Flight One~~

Date: 9-27-95

Site: A3

Plain Text BER Data
1x10^{-2} (1%) is Passing

XMT

Range From A3	Time	16 KBPS Manpack	4.8 KBPS Manpack	16 KBPS AS-3900	4.8 KBPS AS-3900	A15 Receiving	A3 Receiving	Heading One	Heading Two	
A15				366×10^{-5}						PA
				313×10^{-5}						[illegible]
				432×10^{-5}						M
				NOTHING						LO
					180×10^{-5}					M
					167×10^{-5}					HI
					164×10^{-5}					PA

Data Taken By: ______________________ Verified By: [signature]

~~Data Sheet Flight~~ ____________

Date: 9-27-95
Site: A3

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

~~Range From A3~~	Time	16 KBPS Manpack	4.8 KBPS Manpack	16 KBPS AS-3900	4.8 KBPS AS-3900	A15 Receiving	A3 Receiving	Heading One	Heading Two	
A3	1354 30			3.58×10^{-3}						HI
	13 55 00			4.16×10^{-2}						MED
				RT SYNC						Lo
				RT SYNC						PA
					9.74×10^{-3}					PA
	13:57				1.4×10^{-4}					HI
					2.69×10^{-3}					MED
				NO SYNC						PA
				$5.77 \times 10^{-?}$						HI
				$32.69 \times 10^{-?}$						HI
					$3.[illegible] \times 10^{-3}$					HI
					3.00×10^{-5}					HI
					0×10^{-5}					PA
				2.29×10^{-3}						PA

Data Taken By: ____________ Verified By: [signature]

Data Sheet Flight 4

Date: 9/27/95
Site: A15

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

Range From A3	Time	16 KBPS Manpack	4.8 KBPS Manpack	16 KBPS AS-3900	4.8 KBPS AS-3900	A15 Receiving	A3 Receiving	Heading One	Heading Two
15	19:58:28		NDS			✓		029 IN BOUND	
13	19:59:03		NDS			✓		"	
13	20:00:25		NDS			✓		"	
12	20:01:35		NDS			✓		"	
10	20:04:13		NDS			✓		"	
9	20:06:08		NDS			✓		"	
6	20:07:24		NDS			✓		"	
5	20:09:15		1.38×10^{-1}			✓		"	
	:					✓		"	
5	20:11:37		1.69×10^{-1}			✓		135 ~~IN BOUND~~	
5	20:13:27		1.749×10^{-5}				✓	"	
5	20:15:54		1.930×10^{-5}				✓	315 ~~[illegible]~~	
5	20:17:40		1.691×10^{-5}				✓	"	

BATT PACK CHG'D

Data Taken By:

Verified By:

Data Sheet Flight #5

Date: 9-28-95
Site: A15

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

Range ~~From A3~~	Time	16 KBPS Manpack	4.8 KBPS Manpack	16 KBPS AS-3900	4.8 KBPS AS-3900	A15 Receiving	~~A3~~ Receiving	Heading One	Heading Two	POWER
27 nm.	12:27:20				223 x10^{-5}		✓	180°		PA
	12:29 00				292 x10^{-5}			"		
	12:30				481 x 10^{-5}			360°		
	12:34 45				701 x 10^{-5}					H!
	12:36			1913x10^{-5}	~~1913 x10^{-5}~~			360-180		PA TURN
	12:37			1533 x10^{-5}	~~1533 x10^{-5}~~			180°		
~~35/20~~ 39	12:40				281 x10^{-5}			100° ~~360°~~		
35	12:42				2.38 x10^{-2}	✓		100°		H!
	12:43				6.05 x10^{-3}	✓		360°		
					8.72x10^{-3}	CT		"		
	12:46:				2.42x10^{-3}	CT		180°		
	12:47:00			3.05x10^{-}		CT				
	12:48			3.62x10^{-2}		CT				
	12:50			772x10^{-5}			CT	360°		PA
	12:51				59x10^{-5}		CT			
	12:52				274x10^{-5}		✓			

120°

Data Taken By: ____________________ Verified By: Warren W. Dl[illegible]

Data Sheet Flight #5

Date: 9-28-95

Site: A15

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

Range From A3	Time	16 KBPS Manpack	4.8 KBPS Manpack	16 KBPS AS-3900	4.8 KBPS AS-3900	A15 Receiving	~~A3~~ Receiving	Heading One	Heading Two
35	12:51:10				219×10^{-5}		✓	180°	
	~~12:58~~:00				36×10^{-5}		CT		
				1324×10^{-5}			CT		
	12:58			1213×10^{-5}			✓	360°	
				1280×10^{-5}			✓		
40	13:06			1420×10^{-5}			✓	360	
				1143×10^{-5}			CT		
	13:07:15			961×10^{-5}			CT	180	
	13:07:50			1269×10^{-5}			✓		
	13:08:20				177×10^{-5}		✓		
	13:09:10				71×10^{-5}		CT		
	13:11:20				6.29×10^{-3}	CT			
					1.91×10^{-2}	CT		360	
					6.84×10^{-3}	CT			
	13:15:15				1.7×10^{-2}	✓			
	13:15:30			5.35×10^{-2}		✓			

POWER
PA
HI

Data Taken By: ______

Verified By: Warren W. Dl[illegible]

Data Sheet Flight #5

Date: 9-28-95
Site: A15

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

Range From A3	Time	16 KBPS Manpack	4.8 KBPS Manpack	16 KBPS AS-3900	4.8 KBPS AS-3900	A15 Receiving	A3 Receiving	Heading One	Heading Two	
40	13:15:30			4.45×10^{-2}		CT		360		HI
	13:17.45			3.09×10^{-2}		CT		180		
	13:18:10			2.74×10^{-2}		✓				
	13:18:30				2.11×10^{-3}	✓				
	13:19:30				3.08×10^{-3}	CT				
40 < 45					3.51×10^{-2}	CT		100		
	13:22:45				4.84×10^{-2}	✓				
	13:24:45				221×10^{-5}		✓			PA
					63×10^{-5}		CT			
45	13:26:50				215×10^{-5}		CT	180		
	13:28:00				287×10^{-5}		✓			
				1622×10^{-5}			✓			
	13:30			1622×10^{-5}			CT			
	13:32			1.21×10^{-1}		CT				HI
	13:33			9.20×10^{-2}		CT		360		
	13:34			7.56×10^{-2}		✓				

Data Taken By: ____________________

Verified By: Warren W. [signature]

Data Sheet Flight #5

Date: 9-28-95
Site: A15

Plain Text BER Data
1×10^{-2} (1%) is Passing

Range From A3	Time	16 KBPS Manpack	4.8 KBPS Manpack	16 KBPS AS-3900	4.8 KBPS AS-3900	A15 Receiving	A3 Receiving	Heading One	Heading Two	POWER LEVEL
45	13:35				1.82×10^{-2}	✓		360		HI
	13:36				1.06×10^{-2}	CT				
	13:39				47×10^{-5}		CT			PA
	13:40				220×10^{-5}		✓			
	13:41			808×10^{-5}			✓			
	13:42			747×10^{-5}			CT			
	13:44			4.57×10^{-2}		CT		180		HI
	13:45			9.21×10^{-2}		✓				
	13:46				2.15×10^{-2}	✓				
	13:47				2.45×10^{-2}	CT				
50 → 45	13:49				3.00×10^{-2}	CT		270		
|	13:51			9.48×10^{-2}		CT		|		
50	13:52			9.69×10^{-2}		CT		180		
	13:53			1.02×10^{-1}		✓				
	13:54				3.59×10^{-2}	✓				
	13:55				3.90×10^{-2}	CT				

Data Taken By: ______________________ Verified By: Warren W. Dem

Data Sheet Flight #5

Date: 9-28-95
Site: A15

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

Range From A3	Time	16 KBPS Manpack	4.8 KBPS Manpack	16 KBPS AS-3900	4.8 KBPS AS-3900	A15 Receiving	A3 Receiving	Heading One	Heading Two	POWER LEVEL
50	13:57				$3.40x10^{-2}$	CT		360		HI
	13:58				$2.90x10^{-2}$	✓				
	13:58			$1.11x10^{-1}$		✓				
	13:59			$8.86x10^{-2}$		CT				
	14:00			$721x10^{-5}$			CT			PA
	14 02			$1052x10^{-5}$			✓			
	14:02				$210x10^{-5}$		✓			
	14:03				$28x10^{-5}$		CT			
	14:04				$80x10^{-5}$		CT	180		
	14:05				$291x10^{-5}$		✓			
	14:05			$1972x10^{-5}$			✓			
	14:06			$1716x10^{-5}$			CT			
	14:09			Sync lost		CT				PA @ D1B

Data Taken By: ____________________ Verified By: [illegible]

[illegible] 8[illegible]-225

Data Sheet Flight #5

Date:
Site

Voice Communication Data Sheet

Range	Time	Voice Quality: Signal: Strong	Weak	Broken	Audio: Good	Readable	Poor	Mode: PT	CT
360°	12 25			✓		✓		✓	
	13:00							✓	
	1305			X			X	✓	
	1306		X			X	X	✓	
	1307		X			X			X
	[illegible]07		✓		X				X
	1[illegible]		X		X				

PA[illegible]

Data Taken By:
Verified By: Warren W. [illegible]

Data Sheet Flight 5

Date: 9/28/95

Site D18

Voice Communication Data Sheet

	Range	Time	Voice Quality						Mode		
			Signal			Audio					
	Range	Time	Strong	Weak	Broken	Good	Readable	Poor	PT	CT	
	25	12:[illegible]			✓		✓		✓		
	25	12:14			✓		✓		✓		PA
	25	12:15			✓		✓		✓		
	25	12:15			✓		✓		✓		
	25	12:16			✓		✓				NI
360°	27	1217			✓		✓			✓	
	27	12:19				✓	✓			✓	
	27	12:25				✓	✓			✓	
	27	12:26			✓		✓		✓		PA
	27	12:26				✓	✓		✓		
	15	13:01	✓			✓	✓				
	15	13:02	✓			✓	✓				
	15	13:03	✓			✓	✓				
	15	13:04	✓			✓	✓				36[illegible]
	15	13:04	✓			✓	✓				
	15	13:05			✓		✓				
	15	13:05			✓	✓	✓				
	25	14:13	✓			✓	✓				
	25	14:13	✓			✓	✓				
	23			✓		✓	✓				

Data Taken By: [signature]

Verified By: [signature]

Data Sheet Flight 5

Date: 9/28/95
Site: D1B

Plain Text BER Data
1x10^{-2} (1%) is Passing

Range From A15	Time	16 KBPS AS3900	4.8 KBPS AS-3900	A15 Receiving	D1B ~~D1A~~ Receiving	Heading One	Heading Two
25	12:28:5[illegible]		[illegible]		✓	180°	PT
25	12:29:30		292 x 10^{-5}		✓	180°	
27	12:33:08		481 x 10^{-5}		✓	360°	
27	12:34:19		701 x 10^{-5}		✓	"	
27	12:37:09	1913 x 10^{-5}			✓	"	
27	12:31:05	1533 x 10^{-5}			✓	180°	
(20)	12:40:45		281 x 10^{-5}		✓	100°	
35	12:42:53		2.38 x 10^{-2}	✓		"	
35	12:44:08		6.05 x 10^{-3}	✓		360	
35	12:45:14		8.72 x 10^{-3}	✓		"	
35	12:48:50		2.42 x 10^{-3}	✓		180	
35	12:47:51	3.05 x 10^{-2}		✓		"	
35	12:48:52	3.62 x 10^{-2}				"	CT
20	12:50:36	772 x 10^{-5}			✓	360°	
20	12:51:38		159 x 10^{-5}		✓	"	

PA

HI Turn

PA
HI

Data Taken By: Willy Rivera [signature]   Verified By: [signature]

Data Sheet Flight 5

Date: [illegible]-3/95
Site: D1B

BER / Aircraft Heading

A15 Antenna AS3900
D1A Antenna AS3900

Time	Heading	16 KBPS	4.8 KBPS	Plain Text	Cypher Text
12:53:03	360		274x10-5	✓	
12:54:54	180		219x10-5	✓	
12:56:32	180		36x10-5		✓
12:57:07		[illegible]x10-5			✓
12:58:57	360	1213x10-5		✓	
[illegible]	"	128x10-5		✓	
13:02:14	360	14[illegible]		✓	
13:07:05		1143x10-5			✓
13:08:15	180	96x10-5			✓
13:08:48	"	1263x10-5		✓	
13:09:30	"		177x10-5	✓	
13:10:11	"		71x10-5		✓
13:25:36	100		231x10-5	✓	
13:26:18	100		63x10-5		✓
13:28:07	180		214x10-5		✓

Data Taken By: Willy L. Rog[illegible] Verified By: [signature]

Data Sheet Flight 5

Date: 9/28/95
Site: D1B

BER / Aircraft Heading

A15 Antenna AS3900
D1A Antenna AS3900

Range	Time	Heading	16 KBPS	4.8 KBPS	Plain Text	Cypher Text
15	13:29:05	180		287×10^{-5}	✓	
"	13:30:02	"	1622×10^{-5}		✓	
"	13:30:32	"	1622×10^{-5}			✓
"	13:40:02	360		47×10^{-5}		✓
"	13:40:51	"		220×10^{-5}	✓	
"	1[illegible]:43	"	808×10^{-5}		✓	
"	13:42:20	"	747×10^{-5}			✓
15	[illegible]46	[illegible]	121×10^{-5}			✓
"	[illegible]:28	"		1052×10^{-5}	✓	
"	14:01:58	"		210×10^{-5}	✓	
"	14:03:13	"		28×10^{-5}		✓
"	14:[illegible]:43	180		80×10^{-5}		✓
"	14:05:29	"	291×10^{-5}		✓	
"	14:06:39	"	1972×10^{-5}		✓	
"	14:[illegible]:01	"	1716×10^{-5}			✓

Data Taken By: [signature] Verified By: [signature]

Data Sheet Flight One

Heading 1 - 315°
2 - 135°

Date: 9/21/95
Site: A-15

Encl (2)

Plain Text BER Data
$1x10^{-2}$ (1%) Is Passing

(MANPACK PWR ANT AT 30')

Range From A3	Time Z	16 KBPS Manpack	4.8 KBPS Manpack	16 KBPS AS-3900	4.8 KBPS AS-3900	A15 Receiving	A3 Receiving	Heading One	Heading Two
5NM	2148	X				LOSS SYNC NO LINK			X
5NM	2149	X				"			X
5NM	2152	X				RT SNYC NO BER TO HIGH		X	
5NM	5153.	X				RT SNYC BER TO HIGH		X	
5NM	2155.28		X			RT SNYC NO BER TO HIGH			X
5NM	2156.42		X			RT SNYC BER 17%			X
5NM	2158.20		X			RT SNYC 1.07E-10^-1			X
5NM	2200.50		X			RT SNYC 9.36E 10^-2		X	
5NM	2201.50		X			RT SNYC 7X10^-2		X	
5NM	2202.33		X		X	RT SNYC 9X10^-2		X	
5NM	2208.42				X	NO SYNC W/AC		X	
5NM	2209.14				X	RT SYNC 2.3E^-4		X	
	2209.50				X	RT SYNC 1X10^-4		X	
	2211.35				X	RT SYNC 1.83^-3			X
5NM	2212.21				X	1.5E^-4			X

Data Taken By: Edward [signature]

Verified By: Warren W. [signature]

①

Heading 1 - 315°
2 - 135°

Data Sheet Flight One

Date: 9/21/95
Site: A-15

Encl (2)

Plain Text BER Data
1×10^{-2} (1%) is Passing

(MANPACK PWR ANT AT 30')

Range From A3	Time Z	16 KBPS Manpack	4.8 KBPS Manpack	16 KBPS AS-3900	4.8 KBPS AS-3900	A15 Receiving	A3 Receiving	Heading One	Heading Two
5NM	2118	X				LOSS SYNC NO LINK			X
5NM	2149	X				"			X
5NM	2152	X				RT SNYC NO BER TO HIGH		X	
5NM	5153.	X				RT SNYC BER TO HIGH		X	
5NM	2155.28		X			RT SNYC NO BER TO HIGH			X
5NM	2156.42		X			RT SNYC BER 1790			X
5NM	2158.20		X			RT SNYC 1.07E-10-1			X
5NM	2200.50		X			RT SNYC 9.36E 10-2		X	
5NM	2201.50		X			RT SNYC 7X10-2		X	
5NM	2202.33		X		X	RT SNYC 9X10-2		X	
5NM	2208.42				X	NO SYNC W/AC		X	
5NM	2209.14				X	RT SYNC 2.3E-4		X	
"	2209.50				X	RT SYNC 1X10-4		X	
"	2211.35				X	RT SYNC 1.83-3			X
5NM	2212.21				X	1.5E-4			X

Data Taken By: Edward [signature] Verified By: Warren W. Dav.

Heading 1 -315
2 135

②

Data Sheet Flight One

Date: 9/21/95
Site: A-15

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

(MANPACK PWR ANT AT 30')

Range From A3	Time	16 KBPS Manpack	4.8 KBPS Manpack	16 KBPS AS-3900	4.8 KBPS AS-3900	A15 Receiving	A3 Receiving	Heading One	Heading Two
5NM	2213.25			X		RT SYNC 3×10^{-3}			X
	2213.51			X		RT SYNC 6×10^{-3}			X
	2214.20			X		9×10^{-3}			X
	2215.46			X		NO RT SNYC		X	
	2216.23			X		NO RT SNYC		X	
5NM	2216.56			X		RT SNYN NO DATA SNYC		X	
10NM	2221.48				X	RT SNYNC 3×10^{-3}			X
10NM	2222.33				X	RT SNYN 2×10^{-3}			X
10NM	2224.01				X	RT SNYC 2×10^{-3}		X	
10NM	2224.42				X	NO RT SNYC		X	
10NM	2225.06				X	RT SNYC 4×10^{-3}		X	
15NM	2241.24				X	RT SNYC NO DATA SNYC			X
	2241.46				X	RT SNYC NO DATA	SNYC		X
	2242.08				X	RT SNYC 2×10^{-3}			X
15NM	2242.45				X	RT SNYC 2×10^{-3}			X

Data Taken By: Edward [signature] Verified By: Warren W. [signature]

③

Heading 1 - 315
2 - 135

Data Sheet Flight One

Date: 9/21/95
Site: A-15

Plain Text BER Data

$1x10^{-2}$ (1%) is Passing

manPACK PWR ANT 30'

Range From A3	Time	16 KBPS Manpack	4.8 KBPS Manpack	16 KBPS AS-3900	4.8 KBPS AS-3900	A15 Receiving	A3 Receiving	Heading One	Heading Two
15NM	2245.10				X	RT SNYC $2 X 10^{-3}$		X	
15NM	2245.50				X	RT SNYC $3 X 10^{-3}$		X	
20NM	2251.54				X	RT SNYC $2.04 X 10^{-3}$			X
20NM	2252.50				X	RT SNYC $2.23 X 10^{-3}$			X
20NM	22 53.25				X	RT SNYC $1.82 X 10^{-3}$			X
20NM	2254.49				X	RT SNYC $5.57 X 10^{-3}$		X	
20NM	2255.34				X	RT SNYC $3.99 X 10^{-3}$		X	
25NM	2211.25				X	RT SNYC $4.13 X 10^{-3}$		X	
25NM	2311.58				X	RT SNYC $4.62 X 10^{-3}$		X	
25NM	2313.35				X	RT SNYC $3.21 X 10^{-3}$			X
25NM	2314.12				X	RT SNYC $4.89 X 10^{-3}$			X

Data Taken By: Edward [illegible] Verified By: Warren W. [illegible]

4

Data Sheet Flight One

Date: 9/21/95
Site: A-15

BER / Aircraft Heading
AS-3900 Antennas at Site A15

Range 18NM

Time	Heading	16 KBPS	4.8 KBPS	Plain Text	Cypher Text
2318.45	360°	18NM 6.92×10^{-2}		X	
2318.58	360°	18NM 6.58×10^{-2}		X	
2321.10	180°	18NM LOSSING SNYC		X	
2321.25	180°	18NM 1.24×10^{-1}		X	
2321.43	180°	18NM 1.09×10^{-1}		X	
2322	180	18NM	18NM 3.3×10^{-2}	X	
2322.	090°	19NM 2.86×10^{-2}		X	
2323.56	090°	19NM 2.21×10^{-2}		X	
2324.23	090		19NM 1.70×10^{-3}	X	
2324.51	090		19NM 5.4×10^{-4}	X	
2325.12	270°	19.5NM 7.69×10^{-2}		X	
2326.41	270°	19.5NM BAD DATA		X	
2327.10	270°		19.5NM 1.44×10^{-2}	X	
2327.46	270		19.5NM 4.08×10^{-3}	X	

Data Taken By: Edward [signature] Verified By: Dane W [signature]

Data Sheet Flight One

Date: 9/12
Site: #2

Plain Text BER Data
1x10^{-2} (1%) Is Passing

Range From A3	Time	16 KBPS Manpack	4.8 KBPS Manpack	16 KBPS AS-3900	4.8 KBPS AS-3900	A15 Receiving	A3 Receiving	Heading One	Heading Two
5	2131:10	34 10-2							
✓		58X10-4							
✓		80X10-4							✓
✓	39.19	41 -4							✓
✓	39.41	538X10-5							✓
✓	39.58	453X10-5							✓
✓	4021	642X10-5							✓
✓	4308	343X10-5						315	
✓	4310	410X10-5						✓	
✓	4338	348X10-5						✓	
✓	4409	587X10-5						✓	
✓	4451	826X10-5						✓	
✓	4505	743X10-5						✓	

Data Taken By: [signature]

Verified By: [signature]

Data Sheet Flight One

Date: 9/12
Site: #2

Plain Text BER Data
1×10^{-2} (1%) Is Passing

Range From A3	Time	16 KBPS Manpack	4.8 KBPS ~~Manpack~~ AS-3900	16 KBPS AS-3900	4.8 KBPS AS-3900	A15 Receiving	A3 Receiving	Heading One	Heading Two
10	222721		481X10-5						135
✓	2809		456X10-5						✓
✓	2847		461X10-5						✓
✓	3040		439X10-5					315	
✓	3122		468X10-5					✓	
15	3627		458X10-5						135
✓	3735		41X10-4						✓
✓	3901		42X10-4					315	
✓	3952		493X10-5					✓	
20	5701		470X10-5					315	
✓	5854		472X10-5						135
✓	230023		482X10-5						✓
✓	0149		486X10-5					315	
25	0731		470X10-5						135
✓	1817		485X10-5						

Data Taken By: Mary T. Doherty

Verified By: Dale Mourey

Data Sheet Flight One

Date: 9/12
Site: #2

Plain Text BER Data
$1x10^{-2}$ (1%) Is Passing

Range From A3	Time	16 KBPS Manpack	4.8 KBPS Manpack	16 KBPS AS-3900	4.8 KBPS AS-3900	A15 Receiving	A3 Receiving	Heading One	Heading Two
25	23 10 08				514x10-5			5/5	
	10 56				547x10-5				

Data Taken By: [signature]

Verified By: [signature]

Ht. 20 F 200 Preset 2
D1A F300 Preset 3

50 WATTS
Data Sheet Flight Two

Heading 1 = Ø2Ø°
2 = 2ØØ°

①

Date: 9/22/95
Site: A-15

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

	Range From A15	Time	16 KBPS AS3900	4.8 KBPS AS-3900	A15 Receiving	D1A Receiving	Heading One	Heading Two	
	25NM	1936.06	LOSS SNYC		X		X		
	25NM	1936.56	LOSS SNYC		X		X		
	25NM	1937.30	RT SNYC NO DATA SNYC		X		X		
	25NM	1938.14	RT SNYC NO DATA SNYC		X		X		
	25NM	1940.10	$8.63 \times 1Ø^{-3}$		X			X	
	25NM	1940.38	LOSS SNYC		X			X	
	25NM	1941.15	LOSS SNYC		X			X	
	25NM	1942.00		1.09×10^{-3}	X			X	
	25NM	1942.47		9.58×10^{-3}	X			X	
	25NM	1944.55		1.40×10^{-2}	X		X		
	25NM	1945.40		$1.Ø8 \times 10^{-2}$	X		X		
4W	25NM	1946.46		$1.05 \times 1Ø^{-2}$	X		X		
4W	25NM	1947.59		$3.83 \times 1Ø^{-3}$	X		X		*over Land, N-Seal
4W	25NM	1950.25		2.11×10^{-3}	X			X	
4W	25NM	1951.18		4.07×10^{-3}	X			X	over water

Data Taken By: Edward [signature] Verified By: Warren W. [signature]

(1)

Heading 1 = 020°
2 = 200°

Data Sheet Flight Two

Date: 9/22/95
Site: A-15

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

	Range From A15	Time	16 KBPS AS3900	4.8 KBPS AS-3900	A15 Receiving	D1A Receiving	Heading One	Heading Two	
50w	25NM	1952.27		1.12×10^{-2}	X			X	
50w	25NM	1953.07		6.99×10^{-3}	X			X	
50w	30NM	1958.44		3.36×10^{-3}	X		X		
	30NM	1959.28		5.19×10^{-3}	X		X		
	30NM	2000.34		7.11×10^{-3}	X		X		
	30NM	2001.42		1.38×10^{-2}	X		X	PARTLY	over land
50w	30NM	2002.34		3.26×10^{-3}	X		X		TOTAL over land
	30NM	2004.01		7.48×10^{-3}	X			X	over water
	30NM	2004.45		4.04×10^{-3}	X			X	
50w	30NM	2005.23		9.52×10^{-3}	X			X	
	35NM	2023.31		5.32×10^{-3}	X		X		
	35NM	2024.32		1.23×10^{-2}	X		X		
	|	2025.58		1.06×10^{-2}	X			X	
	|	2026.55		1.13×10^{-2}	X			X	water
50w	35NM	2027.38		1.15×10^{-2}	X			X	

Data Taken By: Edward [signature] Jr. Verified By: Warren W. [signature]

(3)

Heading 1 = 020°
2 = 200°

Data Sheet Flight Two

Date: 9/22/95
Site: A-15

Plain Text BER Data
1x10^{-2} (1%) is Passing

	Range From A15	Time	16 KBPS AS3900	4.8 KBPS AS-3900	A15 Receiving	D1A Receiving	Heading One	Heading Two	
50w	35NM	2028.22		1.01×10^{-2}	X			X	
	/	2030.40		9.35×10^{-3}	X		X		
	35NM	2031.27		1.05×10^{-2}	X		X		
	40NM	2036.40		9.96×10^{-3}	X		X		
		2037.37		5.58×10^{-3}	X		X		
		2038.10		8.11×10^{-3}	X		X		
		2039.43		2.34×10^{-3}	X			X	land
		2040.21		1.39×10^{-2}	X			X	water
		2041.02		1.67×10^{-2}	X			X	water
50w	40NM	2041.58		8.80×10^{-3}	X			X	
	45NM	2105.52		NOT RECEIVING	X		X		
	45NM	2106.22		9.80×10^{-3}	X		X		
	45NM	2107.12		2.71×10^{-2}	X		X		land
	45NM	2107:57		1.34×10^{-2}	X		X		
	45NM	70:02		NOT RCVNG	X			X	

Data Taken By: Edward [illegible] Jr

Verified By: Warren W. [illegible]

(4)

Data Sheet Flight Two

Heading 1 = 020°
2 = 200°

Date: 9/22/95
Site: A-15

Plain Text BER Data
1x10^{-2} (1%) is Passing

Range From A15	Time	16 KBPS AS3900	4.8 KBPS AS-3900	A15 Receiving	D1A Receiving	Heading One	Heading Two
50W 45NM	2/10.40		7.23×10^{-3}	X			X
45NM	2/11.11		1.54×10^{-2}	X			X
45NM	2/11.58		1.54×10^{-2}	X			X

Data Taken By: Edward Hearing Verified By: Warren W. Dean they 3 mi's off shore

①

Data Sheet Flight One

A-15 TRANSMITTING

"Z" TIME

Date: 9/22/95
Site: A-15

BER / Aircraft Heading
AS-3900 Antennas at Site A15 & D1A

D1A Receiving

Time	Heading	16 KBPS	4.8 KBPS	Plain Text	Cypher Text
21 17.25	045°		514 x 10^-5	X	
21 17.58	045°		531 x 10^-5	X	
21 20.05	315°		554 x 10^-5	X	
21 20.46	315°		518 x 10^-5	X	
21 22.21	225°		813 x 10^-5		X
21 23.06	225°		NO RCVNG	X	
21 23.30	225°		1194 x 10^-5	X	
21 24.32	225°		1120 x 10^-5	X	
21 25.59	135°		NO SNYC	X	
21 26.37	135°		OVERLOAD	X	
21 26.57	135°		217 x 10^-4	X	

Data Taken By: Edward Fleming Jr. Verified By: James W. Dean

Data Sheet Flight Two

Date: 9/22/95
Site: D/A

Plain Text BER Data
1x10^{-2} (1%) is Passing

Range From A15	Time	16 KBPS AS3900	4.8 KBPS AS-3900	A15 Receiving	D1A Receiving	Heading One	Heading Two
25	192927	989x10^{-5}				20	
	3220	978x10^{-5}					200
	3301	1081x10^{-5}					X
	3522	1240x10^{-5}				X	
30	200637		557x10^{-5}				X
	200722		548x10^{-5}				X
	0758		580x10^{-5}				X
	0950		466x10^{-5}			20	
	1030		451x10^{-5}			X	
	1100		462x10^{-5}			X	
35	1640		737x10^{-5}				X
	1801		574x10^{-5}				X
	1842		685x10^{-5}				X
	2030		464x10^{-5}			20	
	2100		462x10^{-5}			X	

Data Taken By: Willy L. Legin Verified By: [illegible]

Data Sheet Flight Two

Date: 9/22/95
Site: D/A

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

Range From A15	Time	16 KBPS AS3900	4.8 KBPS AS-3900	A15 Receiving	D1A Receiving	Heading One	Heading Two
35	202150		448×10^{-5}			20	
40	4307		834×10^{-5}				200
	4400		831×10^{-5}				X
	4445		979×10^{-5}				X
	4652		463×10^{-5}			20	
	4733		472×10^{-5}			X	
	4809		472×10^{-5}			X	
	4917		477×10^{-5}			X	
	5178		737×10^{-5}			X	
	5365		700×10^{-5}				200
45	5834		1094×10^{-5}				X
	5929		1190×10^{-5}				X
	210012		1044×10^{-5}				X
	0121		1210×10^{-5}				X
	0339		524×10^{-5}			20	

Data Taken By: [illegible] Verified By: [illegible]

Data Sheet Flight Two

Date: 9/22/95
Site: D/A

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

Range From A15	Time	16 KBPS AS3900	4.8 KBPS AS-3900	A15 Receiving	D1A Receiving	Heading One	Heading Two
45	210420		538×10^{-5}			20	
	0457		549×10^{-5}			X	
	1721		514×10^{-5}			045	
	1755		531×10^{-5}			X	
	2012		554×10^{-5}			315	
	2046		518×10^{-5}			X	
	2140		1075×10^{-5}			X	
	2232		813×10^{-5}			225	
	2327		1194×10^{-5}			225	
	2449		1180×10^{-5}			225	
	2706		217×10^{-4}			135	

TURN CT

Data Taken By: Willy L. Legé

Verified By: [signature]

USING RADIO #2

HEADING 1 = 020° D1A PRESET 5
2 = 200° A15 " 2

①

Data Sheet Flight 3

Date: 9/25/95
Site: A-15

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

Range From A15	Time	16 KBPS AS3900	4.8 KBPS AS-3900	A15 Receiving	D1A Receiving	Heading One	Heading Two	
25NM	1522.24		Unit in CT vicP	NO RCV			X	RADIO B
25 NM	1523.18		8.27×10^{-3}	X			X	~~TOP~~ BOTTOM
25NM	1524.05		2.36×10^{-3}	X			X	
25NM	1524.43		3.60×10^{-3}	X			X	
	1526.25		2.14×10^{-3}	X		X		
	1526.58		1.36×10^{-3}	X		X		
25NM	1527.37		1.75×10^{-3}	X		X		
30NM	1548.25		5.8×10^{-4}	X			X	Radio B
	1549.01		4.86×10^{-3}	X			X	" B
	1549.37		6.55×10^{-3}	X			X	" B
	15 50.24		1.53×10^{-3}	X			X	Radio A
	15 51.02		7.21×10^{-3}	X			X	" A
	15 52.41		1.28×10^{-3}	X		X		"
30NM	15 53.14		9.70×10^{-3}	X		X		"
35NM	1558.13	2.84×10^{-2}					X	~~Bot~~ TOP

Data Taken By: Edward Wearing Jr Verified By: Warren W. Klein

HEADING 1 = Ø2Ø°
2 = 2ØØ°

Data Sheet Flight 3

Date: 9/25/95
Site: A-15

Plain Text BER Data
1×10^{-2} (1%) is Passing

Range From A15	Time	16 KBPS AS3900	4.8 KBPS AS-3900	A15 Receiving	D1A Receiving	Heading One	Heading Two	
35NM	1558.50	3.64×10^{-2}		X			X	Radio A TOP
	1559.14		2.40×10^{-3}	X			X	
	1559.54		2.92×10^{-3}	X			X	
	1601.38	3.04×10^{-2}	-	X		X		
	1602.01	3.62×10^{-2}		X		X		
	1602.36		3.64×10^{-3}	X		X		
35NM	1603.16		5.71×10^{-3}	X		X		
40NM	1620.15		1.33×10^{-2}	X		X		Land
	1621.35		2.80×10^{-3}	X			X	"
	1622.10		2.42×10^{-3}	X			X	Land &
	1622.56		2.94×10^{-3}	X			X	*Water
	1624.48		4.95×10^{-3}	X			X	Water
	1625.05		2.44×10^{-3}	X			X	
	1625.36		2.39×10^{-3}	X			X	
40NM	1627.09		2.15×10^{-3}	X		X		Water

Data Taken By: Edward [illegible] Verified By: [illegible]

HEADING 1 - 020°
2 - 200°

(3)

Data Sheet Flight 3

Date: 9/25/95
Site: A-15

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

Range From A15	Time	16 KBPS AS3900	4.8 KBPS AS-3900	A15 Receiving	D1A Receiving	Heading One	Heading Two
40NM	1628.06		3.21×10^{-3}	X		X	
45NM	1645.02		8.28×10^{-3}	X			X
	1645.30		8.85×10^{-3}	X			X
	1646.02		9.11×10^{-3}	X			X
	1647.40		1.47×10^{-2}	X		X	
	1648.17		1.82×10^{-2}	X		X	
45NM	1649.00		1.73×10^{-2}	X		X	

cT

Data Taken By: Edward Dearing Jr

Verified By: Warren W. De...

(1)

Data Sheet Flight 3

XMTR

BER / Aircraft Heading

Date: 9/25/95
Site: 4-13

(1) **A15 Antenna AS3900**
(2) **D1A Antenna AS3900**

	Time	Heading	16 KBPS	4.8 KBPS	Plain Text	Cypher Text	
(2)	1631.45	∅85°		1.69×10^{-7}	X		43 NM
(1)	1632.13	∅85°		1.97×10^{-7}	X		43 NM
(1)	16 53.10	180°		704×10^{-5}	X		
(1)	16 53.30	180°		521×10^{-5}	X		
(1)	16 53.52	180°		284×10^{-5}		X	
(1)	16 55.13	270°		687×10^{-5}	X		
(1)	16 55.45	270°		580×10^{-5}	X		
(1)	16 56.30	270°		384×10^{-5}		X	
(1)	16 58.04	090°		NOTRCVING	X		
(1)	16 58.24	090°		464×10^{-5}	X		
(1)	16 59.03	090°		565×10^{-5}	X		
(1)	16 59.41	090°		334×10^{-5}		X	
(1)	17 00.50	000°		485×10^{-5}	X		
(1)	1701.21	000°		489×10^{-5}	X		
	1701.59	000°		222×10^{-5}		X	

Data Taken By: Edward Wearing Jr. Verified By: Warren W. [illegible]

2

Data Sheet Flight 3

Date: 9/25/95
Site: A-15

BER / Aircraft Heading

1 **A15 Antenna AS3900**
2 **D1A Antenna AS3900**

	Time	Heading	16 KBPS	4.8 KBPS	Plain Text	Cypher Text
1	1704.02	225°		670×10^{-5}	X	
1	1704.52	225°		NOT RCVING	X	
1	1705.18	225°		693×10^{-5}	X	
1	1706.02	225°		492×10^{-5}		X
1	1707.43	135°		501×10^{-5}	X	
1	1708.37	135°		695×10^{-5}	X	
1	1709.03	135°		258×10^{-5}		X
1	1710.18	045°		474×10^{-5}	X	
1	1710.50	045		653×10^{-5}	X	
1	1711.26	045		402×10^{-5}		X
	1712.29	315°		NOT RCVNG	X	
	1712.45	315°		665×10^{-5}	X	
	1713.17	315°		797×10^{-5}	X	
	1713.45	315°		487×10^{-5}		X

Data Taken By: Edward Dearing Jr. Verified By: Warren W. [illegible]

Data Sheet Flight #3

RCV ANTENNA DOWN

Date: 9-25-95

Site: D1A

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

Range From A15	Time	16 KBPS AS3900	4.8 KBPS AS-3900	A15 Receiving	D1A Receiving	Heading One 20°	Heading Two 200°	
25nmi	10:23:43		8.27×10^{-3}	✓			✓	
	10:24:30		2.36×10^{-3}	✓			✓	
	10:25:08		3.60×10^{-3}	✓			✓	
	10:26:30		2.14×10^{-3}	✓		✓		NOISY A.V.
	10:27:28		1.36×10^{-3}	✓		✓		
	10:28:00		1.75×10^{-3}	✓		✓		
	10:29:08		716×10^{-5}		✓	✓		
	10:29:44		861×10^{-5}		✓	✓		TURN
	10:31:05		674×10^{-5}		✓		✓	
	10:31:43		747×10^{-5}		✓		✓	
	10:32:20		672×10^{-5}		✓		✓	
	10:34:04		671×10^{-5}		✓	✓		
	10:34:35		624×10^{-5}		✓	✓		
30nmi	10:39:36		1642×10^{-5}		✓		✓	
	10:40:37		1648×10^{-5}		✓		✓	

Data Taken By: [signature]

Verified By: [signature]

Data Sheet Flight #3

RCV. ANT: DOWN

Date: 9-25-95
Site: D1A

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

Range From A15	Time	16 KBPS AS3900	4.8 KBPS AS-3900	A15 Receiving	D1A Receiving	Heading One 20°	Heading Two 200°
30 nmi	10:41:45		478×10^{-5}		✓		✓
	10:42:25		459×10^{-5}		✓		✓
	10:44:05		506×10^{-5}		✓	✓	
	10:44:38		525×10^{-5}		✓	✓	
	10:45:16		554×10^{-5}		✓	✓	
	10:45:53		1413×10^{-5}		✓	✓	
	10:46:23		1493×10^{-5}		✓	✓	
	10:48:55		5.8×10^{-4}	✓			✓
	10:49:30		4.86×10^{-3}	✓			✓
	10:50:00		6.55×10^{-3}	✓			✓
	10:50:50		1.53×10^{-3}	✓			✓
	10:51:30		7.21×10^{-3}	✓			✓
	10:53:00		1.28×10^{-3}	✓		✓	
	10:53:45		9.7×10^{-4}	✓		✓	
35 nmi	10:58:30	2.84×10^{-2}		✓			✓

JAN 2 SWITCHED RADIOS (BOTTOM RADIO) (RADIO #2)

SWITCHED RADIOS

Data Taken By: [signature]

Verified By: [signature]

Data Sheet Flight #3

Rcv [illegible]

Date: 9-25-95

Site: D1A

Plain Text BER Data
1×10^{-2} (1%) is Passing

Range From A15	Time	16 KBPS AS3900	4.8 KBPS AS-3900	A15 Receiving	D1A Receiving	Heading One 20°	Heading Two 200°	
35 nmi	10:59:00	3.64×10^{-2}		✓			✓	
	10:59:45		2.40×10^{-3}	✓			✓	Noisy Env
	11:00:20		2.12×10^{-3}	✓			✓	
	11:01:50	3.204×10^{-2}		✓		✓		
	11:02:25	3.62×10^{-2}		✓		✓		
	11:03:05		3.64×10^{-3}	✓		✓		
	11:03:40		5.71×10^{-3}	✓		✓		Noisy Env
	11:05:10	141×10^{-4}			✓		✓	
	11:05:44	1912×10^{-5}			✓		✓	
	11:06:30		494×10^{-5}		✓		✓	Very Noisy
	11:07:02		460×10^{-5}		✓		✓	
	11:09:05	255×10^{-4}			✓	✓		
	11:09:22	329×10^{-4}			✓	✓		
	11:10:20		609×10^{-5}		✓	✓		
	11:10:55		727×10^{-5}		✓	✓		

Data Taken By: [illegible] Verified By: [illegible]

60 dB
noise
(3) VAN 2

Data Sheet Flight #3

RCV. ANT. DOWN

Date: 9-25-95
Site: D1A

Plain Text BER Data
1x10^{-2} (1%) is Passing

Range From A15	Time	16 KBPS AS3900	4.8 KBPS AS-3900	A15 Receiving	D1A Receiving	Heading One 020°	Heading Two 200°
40 nmi	11:16:10		571×10^{-5}		✓		✓
	11:17:00		544×10^{-5}		✓		✓
	11:17:34		524×10^{-5}		✓		✓
	11:19:08		658×10^{-5}		✓	✓	
	11:19:40		650×10^{-5}		✓	✓	
	11:20:40		1.33×10^{-2}	✓		✓	
	11:22:00		2.80×10^{-3}	✓			✓
	11:22:45		2.42×10^{-3}	✓			✓
	11:23:55		4.95×10^{-3}	✓			✓
	11:25:25		2.44×10^{-3}	✓			✓
	11:26:00		2.39×10^{-3}	✓			✓
	11:27:35		2.15×10^{-3}	✓		✓	
	11:28:30		3.21×10^{-3}	✓		✓	
45 nmi	11:34:50		667×10^{-5}		✓		✓
	11:35:20		813×10^{-5}		✓		✓

over land

Data Taken By: [signature]

Verified By: [signature]

Data Sheet Flight #3

Date: 9-25-95
Site: D1A

Plain Text BER Data
1×10^{-2} (1%) is Passing

Range From A15	Time	16 KBPS AS3900	4.8 KBPS AS-3900	A15 Receiving	D1A Receiving	020° Heading One	200° Heading Two	
45 nmi	11:40:50		524×10^{-5}		✓	✓		
	11:41:23		402×10^{-5}		✓	✓		
	11:42:30		271×10^{-5}		✓	✓		CT
	11:43:30		288×10^{-5}		✓	✓		CT
	11:45:20		8.28×10^{-3}	✓			✓	
	11:46:00		8.85×10^{-3}	✓			✓	
	11:46:35		9.11×10^{-3}	✓			✓	
	11:48:00		1.47×10^{-2}	✓		✓		
	11:48:50		1.82×10^{-2}	✓		✓		
	11:49:30		1.73×10^{-2}	✓		✓		CT

Data Taken By: ____________ Verified By: ____________

Data Sheet Flight #3

RCV ANT DOWN

Date: 9-25-95

Site: D1A

BER / Aircraft Heading

A15 Antenna AS3900
D1A Antenna AS3900

XMT

A15

45 NM

3000

Time	Heading	16 KBPS	4.8 KBPS	Plain Text	Cypher Text
11:53:00	180°		704×10^{-5}	✓	
11:53:40			521×10^{-5}	✓	
11:54:20			284×10^{-5}		✓
11:55:35	270°		687×10^{-5}	✓	
11:56:05			580×10^{-5}	✓	
11:56:55			384×10^{-5}		✓
11:58:50	90°		464×10^{-5}	✓	
11:59:30			565×10^{-5}	✓	
12:00:05			334×10^{-5}		✓
12:01:12	0°		485×10^{-5}	✓	
12:01:47			489×10^{-5}	✓	
12:02:27			222×10^{-5}		✓
12:04:25	225°		670×10^{-5}	✓	
12:05:41			693×10^{-5}	✓	
12:06:20			492×10^{-5}		✓

Data Taken By: [signature]

Verified By: [signature]

Data Sheet Flight #3

RCV ANT DOWN

Date: 9-25-95

Site: D1A

BER / Aircraft Heading

A15 Antenna AS3900

D1A Antenna AS3900

Time	Heading	16 KBPS	4.8 KBPS	Plain Text	Cypher Text
12:08:20	135°		501×10^{-5}	✓	
12:08:57	|		695×10^{-5}	✓	
12:09:34	|		258×10^{-5}		✓
12:10:44	45°		474×10^{-5}	✓	
12:11:14	|		653×10^{-5}	✓	
12:11:48	|		402×10^{-5}		✓
12:13:10	315°		665×10^{-5}	✓	
12:13:40	|		797×10^{-5}	✓	
12:14:10	|		487×10^{-5}		✓

Data Taken By:

Verified By:

F300

Data Sheet ~~Flight One~~

Date: 9/26/95
Site: A-15

A15 → A3

BER / Aircraft Heading
AS-3900 Antennas at Site A15

Time	~~Heading~~	~~16 KBPS~~ 16KBPS.	4.8 KBPS	Plain Text	Cypher Text
Top 22	Hi	152×10^{-5}	173E-5	X	
	med	805×10^{-5}	$158\ 10^{-5}$	X	
	Low		No Rec	X	
Bottom 21	Hi	265×10^{-5}	172×10^{-5} ~~265X10~~	X	
	med	428×10^{-5}	171×10^{-5}	X	
	Low	NO SNYC	—	X	
	PA (1)	147×10^{-5}	176×10^{-5}	X	
	(2)	146×10^{-5}	160×10^{-5}	X	
Top 21	Hi 349	[illegible] $\times 10^{-5}$	165×10^{-5}	X	
	med	624×10^{-5}	160×10^{-5}	X	
	Low	NA —	NA —		
Bottom 22	Hi	259×10^{-5}	163×10^{-5}	X	
	med	417×10^{-5}	162×10^{-5}	X	
	Low	NA —	NA —		
	PA (1)	419×10^{-5}	177×10^{-5}	X	
	(2)	160×10^{-5}	171×10^{-5}	X	

(3) 154×10^{-5}
(4) 155×10^{-5}

Data Taken By: Edward [signature]

Verified By:

(2)

A3 → A15

Data Sheet ~~Flight One~~

Date: 9/26/95
Site: A-15

BER / Aircraft Heading
AS-3900 Antennas at Site A15

Time	Heading	16 KBPS	4.8 KBPS	Plain Text	Cypher Text
Bottom.	Hi (1)	7.70×10^{-4}	0.0×10^{-5}		
23	med	1.08×10^{-2}	5.1×10^{-4}		
	Low	NA —	—		
	PA	RCVNG BUT NO SNYC	1.03×10^{-1}		
	HI (2)	1.70×10^{-3}			

Data Taken By: Edward Dearing Jr Verified By: ____

A3 XMT

Data Sheet Flight #4
RCV ANT. DOWN

Date: 9-26-95
Site: A3

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

~~315~~ 135

Range From A3	Time	16 KBPS Manpack	4.8 KBPS Manpack	16 KBPS AS-3900	4.8 KBPS AS-3900	A15 Receiving	A3 Receiving	Heading One	Heading Two	
				7.70×10^{-4}						HI
				1.70×10^{-3}						HI.
				NO SYNC						PA
				1.08×10^{-2}						MED
				NO SYNC						LO
				5.1×10^{-4}						MED
				0.0×10^{-5}						HI
										PA

Data Taken By: ______________________ Verified By: ______________________

A15 XmT

Data Sheet Flight ~~[illegible]~~

Date: 9-26-95
Site: A3

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

Range From A3	Time	16 KBPS Manpack	4.8 KBPS Manpack	50' TOWER 16 KBPS AS-3900	50' TOWER 4.8 KBPS AS-3900	A15 Receiving	A3 Receiving	315° Heading One	135° Heading Two	
					$17\_ \times 10^{-5}$					50W
					158×10^{-5}					4W
					805×10^{-5}					med.
				152×10^{-5}	...					4W SWITCH [illegible]
				265×10^{-5}						50W ?
				428×10^{-5}						MED
				DID NOT RCV						LOW
				147×10^{-5}						PA (50W
				146×10^{-5}						"
					176×10^{-5}					"
					160×10^{-5}					"
					172×10^{-5}					HIGH
					171×10^{-5}					MED
					170×10^{-5}					PA SWITCH-RANK
					165×10^{-5}					HIGH
					160×10^{-5}					MED

Data Taken By: ______________________ Verified By: ______________________

A15 XMT

Data Sheet Flight #4

RCV. ANT. DOWN

Date: 9-26-95

Site: A3

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

50' TOWER

315° 135°

Range From A3	Time	16 KBPS Manpack	4.8 KBPS Manpack	16 KBPS AS-3900	4.8 KBPS AS-3900	A15 Receiving	A3 Receiving	Heading One	Heading Two	
				624×10^{-5}						MED
				399×10^{-5}						HIGH
				259×10^{-5}						HIGH
				417×10^{-5}						MED
				419×10^{-5}						PA
				160×10^{-5}						PA
					177×10^{-5}					PA
					171×10^{-5}					PA
					163×10^{-5}					HIGH
					162×10^{-5}					MED
				154×10^{-5}						PA
				155×10^{-5}						PA

Data Taken By: ____________________ Verified By: ____________________

Data Sheet Flight 1

Date: 1/24/96
Site: D1A

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

Range/15 From A3	Time	BER	One Channel	Two Channel	A15 Receiving	D1A Receiving	Heading One	Heading Two
35			✓					225
							045	
							300	
								225
35	094524	945 X 10 -5	✓			✓		225
35	094602	795 X 10 -5	✓			✓		225
35	094810	376 X 10 -5	✓			✓	045	
35	094845	415 X 10 -5	✓			✓	045	
35	095040	705 X 10 -5	✓			✓	320	
35	095120	1078 X 10 -5	✓			✓	320	
35	095230	725 X 10 -5	✓			✓	320	
35	095315	1179 X 10 -5	✓			✓	320 (TURN)	
35	095415	804 X 10 -5	✓			✓		225
35	095600	OVER FLOW NO READING				✓		225
35	095700	515 X 10 -4	✓			✓	270	
35	095800	674 X 10 -4	✓			✓	TURN	

Voice Readable
Voice Good Readable
Readable
HIGH ...
HI Pwr
PA

Data Taken By: J. Mounce

Verified By:

3 of 3

Data Sheet Flight ____________

Date: 1/24/96
Site: D1A

Plain Text BER Data
1x10^{-2} (1%) is Passing

Range 15 From A3	Time	BER	One Channel	Two Channel	A15 Receiving	D1A Receiving	Heading One	Heading Two
35	104630	1796 X 10^{-5}		✓		✓		225
35	104700	214 X 10^{-4}		✓		✓		225
35	104800	165 X 10^{-4}		✓		✓		225
35	105630	948 X 10^{-5}		✓		✓	320	
35	105800	858 X 10^{-5}		✓		✓	320	
35	110000	1590 X 10^{-5}		✓		✓	320	
35	110203	1508 X 10^{-5}		✓		✓		45
35	110340	1744 X 10^{-5}		✓		✓		45
35	111245	373 X 10^{-5}		✓?		✓		?

F20

F70

Low

Data Taken By: ______________________ Verified By: ______________________

HD 1 - 225°
HD 2 - 45°

A/C CALL GIL 70

(1)

Data Sheet Flight # 1

Date: 1-24-96
Site: A-15

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

Range From	Time	BER	Data rate	One Channel	Two Channel	A15 Receiving	D1A Receiving	Heading One	Heading Two	XM Pol/Lvl
35 nm		995×10^{-5}	4800	✓			✓	225°		HI
		795×10^{-5}								
	9:48:30	376×10^{-5}							45°	
	9:49:09	415×10^{-5}								
	9:51:10	705×10^{-5}						320°		
	9:51:45	1078×10^{-5}								
	9:53:00	725×10^{-5}								
	9:53:55	1179×10^{-5}						(in turn)		
	9:54:55	804×10^{-5}						225°		
	9:56:00	OVERFLOW								PA
	9:57:00	515×10^{-4}						270°		
	10:00:14	490×10^{-4}							45°	
	10:00:46	578×10^{-4}								
	10:01:20	311×10^{-5}								HI
	10:03:00	No useful data				✓				
	10:03:30	"								

Data Taken By: ______________ Verified By: ______________

VOICE THRU ONE CHAN, MODE WHEN A/C HEADING WAS 129°.

Data Sheet Flight #1

Date: 1-24-96
Site: AIS

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

Range From A15	Time	BER		One Channel	Two Channel	A15 Receiving	D1A Receiving	Heading One	Heading Two	Xmt Power Lvl
35nm	10:05	NO RECEPTION	9800	✓		✓		320		HI
	10:08:05	75% (NUD) NO USEABLE DATA						225°		
	10:09:50	N.U.D.								
	10:11:40	NO SYNC						320°		PA
	10:12:01	NO SYNC								
	10:13:10	NO SYNC								HI
	10:14:	N.U.D.							045	PA
	10:16:00	NO RECEPTION								
		" "						330°		HI
	10:21:10	NUD						330°		
	10:24:30	NUD								PA
	10:26:00	NUD						225°		HI
	10:29:12	1155×10^{-5}					✓			HI
	10:29:51	1155×10^{-5}								
	10:31:50	581×10^{-5}							045	
	10:32:	473×10^{-5}								

Data Taken By: ____________________ Verified By: ____________________

Data Sheet Flight 1

Date: 1-24-96
Site: A-15

Plain Text BER Data
1×10^{-2} (1%) is Passing

Range From A3	Time	BER		One Channel	Two Channel	A15 Receiving	D1A Receiving	Heading One	Heading Two	Xmit Pwr LVL
5 SM	10:33:36	792×10^{-5}	4800		✓		✓		45°	HI
	10:34:17	735×10^{-5}								
	10:36:25	1799×10^{-5}						225°		
	10:36:55	1707×10^{-5}								
	10:37:50	216×10^{-4}								
	10:41:15	500×10^{-5}			CH2 (FA 2+2)				45°	
	10:41:50	677×10^{-5}								
	10:42:20	NO SYNC				✓				
	10:42:55	679×10^{-5}					✓			
	10:44:05	981×10^{-5}						320		
	10:46:50	1796×10^{-5}						225		
	10:47:30	214×10^{-4}			CH2 FA 3+2					
	10:48:10	165×10^{-4}								
	10:48:55	NUD				✓				
	10:52:40	NUD							045°	
	10:5?	948×10^{-5}		CH2 ONLY ✓			✓	320		

Data Taken By: ______________________ Verified By: ______________________

④

Data Sheet Flight 1

Date: 1-24-96
Site: A-15

Plain Text BER Data
$1x10^{-2}$ (1%) Is Passing

Range From A3	Time	BER		One Channel	Two Channel	A15 Receiving	D1A Receiving	Heading One	Heading Two
[illegible]	10:59:03	858 $\times 10^{-5}$	4800	CH1 ✓			✓	320	
	11:00:50	1590 $\times 10^{-5}$						225	
	11:03:23	1508 $\times 10^{-5}$							95
	11:04:18	1744 $\times 10^{-5}$							
						✓		310	
	11:32:00	NO RECEPTION				✓			095
	11:42:30	373 $\times 10^{-5}$					✓		
						✓			

HI

Data Taken By: ______________ Verified By: ______________

Data Sheet Flight 1

Date: 2/14/96

Site: DIA

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

Range From A3	Time	BER	One Channel	Two Channel	A15 Receiving	D1A Receiving	Heading One	Heading Two
35	16:35:00	$471 X10^{-5}$	ON CHANNEL 2			✓	045	
"	16:35:30	$504 X10^{-5}$	✓			✓	045	
"	16:36:00	$803 X10^{-5}$	✓			✓	045	
"	16:37:00	$571 X10^{-4}$	✓			✓		270
"	16:38:00	$273 X10^{-4}$	✓			✓		270
"	16:39:00	$371 X10^{-4}$	✓			✓		
"	16:40:00	$57 X10^{-4}$	✓			✓		
"	16:40:25	$777 X10^{-5}$	✓			✓		
"	16:41:40	$497 X10^{-5}$	✓			✓	225	
"	16:42:00	$580 X10^{-5}$	✓			✓	"	
"	16:42:45	$1003 X10^{-5}$	✓			✓	"	
"	16:43:19	$1009 X10^{-5}$	✓			✓	"	
"	16:50:40	$462 X10^{-5}$	✓			✓	045	
"	16:51:00	$484 X10^{-5}$	✓			✓	045	
"	16:52:00	$532 X10^{-5}$	✓			✓	045	

2 OF 4

Data Sheet Flight 1

Date: 2/14/96
Site: DIA

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

Range From A3	Time	BER	One Channel	Two Channel	A15 Receiving	D1A Receiving	Heading One	Heading Two	
35	16:53:00	67×10^{-4}	✓			✓	045		HI
35	16:53:30	65×10^{-4}	✓			✓	045		HI
"	16:54:00	60×10^{-4}	✓			✓		270	HI
"	16:54:30	478×10^{-4}	✓			✓		270	HI
"	1654[illegible]	477×10^{-4}	✓			✓		270	HI
"	1655[illegible]	108×10^{-4}	✓			✓		270	PA
"	1655[illegible]	104×10^{-4}	✓			✓		270	PA
"	165552	71×10^{-4}	✓			✓	[illegible]	270	PA
"	165700	49×10^{-4}	✓			✓	225		PA
"	165730	54×10^{-4}	✓			✓	225		PA
"	165745	58×10^{-4}	✓			✓	225		PA
"	165800	152×10^{-4}	✓			✓	225		HI
"	165820	127×10^{-4}	✓			✓	225		HI
"	165830	133×10^{-4}	✓			✓	225		HI
"	171000	58×10^{-4}				✓	225		PA

Data Sheet Flight 1

Date: 2/14/96
Site: Dix

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

Range From A3	Time	BER	One Channel	Two Channel	A15 Receiving	DIA Receiving	Heading One	Heading Two	
35	17:10:15	56×10^{-4}	✓			✓	22.5		
"	17:10:30	35×10^{-4}	✓			✓	225		PA
"	17:11:30	131×10^{-4}	✓			✓	"		HI
"	17:11:15	49×10^{-4}	✓			✓	"		HI
"	17:11:23	95×10^{-4}	✓			✓	"		HI
"	17:14:06	68×10^{-4}	✓			✓	22.5		PA
"	171615	53×10^{-4}	✓			✓	"		PA
"	171635	75×10^{-4}	✓			✓	"		PA
"	171645	64×10^{-4}	✓			✓	"		PA
"	171700	133×10^{-4}	✓			✓	"		HI
"	171715	77×10^{-4}	✓			✓	"		HI
"	171730	84×10^{-4}	✓			✓	"		HI
"	171755	109×10^{-4}	✓			✓	"		HI
"	171810	105×10^{-4}	✓			✓	"		HI
"	171820	211×10^{-4}	✓			✓	"		HI

Mn? 15

[illegible]

AIRCRAFT
GIL 27 TEST

UHF 279.7 MHz

Data Sheet Flight 1
(1)

Date: 2-14-96
Site: A15

WDNMSD

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

Range From A3	Time	BER 4800 bps	One Channel	Two Channel	A15 Receiving	DIA Receiving	Heading One 045	Heading Two 225	
	1413	SC VOICE - P.A. LOUD & CLEAR					✓		
35 nm.	15:28:00	NO USEABLE DATA		P2 ✓ P3	✓			✓	
	15:30:30	156×10^{-4}							P.A.
	15:31:40	50×10^{-4}							HIPR
	15:32:20	150×10^{-4}							P.A.
	15:33:45	209×10^{-4}						TURN	P.A.
	15:33:59	51×10^{-4}					✓		HIPR
	15:35:36	471×10^{-5}				✓			P.A.
	15:36:	803×10^{-5}							HIPR
	15:38:55	514×10^{-4}, 223×10^{-4}					270°		
	15:39:	57×10^{-4}, 77×10^{-4}							P.A.
	15:41:	497×10^{-5}						225°	
	15:42:05	580×10^{-5}							
	15:42:50	1000×10^{-5}							HIPR

Data Sheet Flight 1

Date: 2/14/96
Site: DIA

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

DIA 17:14

Range From A3	Time	BER	One Channel	Two Channel	A15 Receiving	D1A Receiving	Heading One	Heading Two	
35	17:19:00	45×10^{-4}	✓			✓		270	PA
"	17:19:10	47×10^{-4}	✓			✓		"	PA
"	17:19:20	49×10^{-4}	✓			✓		"	PA
"	17:20:30	37×10^{-4}	✓			✓	045		PA
"	17:20:45	42×10^{-4}	✓			✓	"		PA
"	17:20:55	48×10^{-4}	✓			✓	"		PA
"	17:21:10	104×10^{-4}	✓			✓	"		HT
"	17:21:25	72×10^{-4}	✓			✓	"		HT
"	17:21:45	106×10^{-4}	✓			✓	"		HT
						✓	"		
						✓	"		
						✓	"		

Data Sheet Flight 1

(3)

Date: 2-19-96

Site: A15

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

Range From A3	Time	BER	One Channel	Two Channel	A15 Receiving	D1A Receiving	Heading One	Heading Two
	15:58:00	152×10^{-4}		✓		✓		225
	15:58:20	127×10^{-4}						
	15:58:40	133×10^{-4}						
	15:59:17	19×10^{-4}			✓			
		76×10^{-4}						
		22×10^{-4}						
	15:59:40	30×10^{-4}						
		77×10^{-4}						
		71×10^{-4}						
		8×10^{-4}						
	15:59:59	63×10^{-4}						
	16:01:50	6.9×10^{-4}					095	
		41×10^{-4}						
		56×10^{-4}						
		63×10^{-4}						

111 Pc. [illegible]

Data Sheet Flight 1

(2)

Date: 2-14-96

Site: A15

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

Range From A3	Time	BER	One Channel	Two Channel	A15 Receiving	DIA Receiving	Heading One 045	Heading Two 225
35nmi	15:43:20	1009×10^{-5}		✓		✓	095	
	15:50:40	462×10^{-5}						
	15:51:10	484×10^{-5}						
	15:52:00	522×10^{-5}						
	15:53:15	67×10^{-9}						
	15:53:20	65×10^{-9}						
	15:54:30	60×10^{-9}					270	
	15:54:40	978×10^{-9}						
	15:54:50	979×10^{-9}						
	15:55:10	108×10^{-9}						
	15:55:	104×10^{-9}						
	15:56:00	71×10^{-9}						
	15:58:30	49×10^{-9}						225
	15:57:36	59×10^{-9}						
	15:57:39	58×10^{-9}						

PA

HI Po

Data Sheet Flight 1
(5)

Date: 3-14-96
Site: A15

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

Range From A3	Time	BER	ch One ~~Channel~~	Two Channel	A15 Receiving	D1A Receiving	Heading One	Heading Two
	10:08:00	20×10^{-4}	✓		✓			225°
		33×10^{-4}						
		19×10^{-4}						
		32×10^{-4}						
		62×10^{-4}						
	10:08:44	19×10^{-4}						
	10:10:~~[illegible]~~	58×10^{-4}				✓		
		56×10^{-4}					✓	
	10:10:42	38×10^{-4}						
	10:11:00	131×10^{-4}						
		49×10^{-4}						
		95×10^{-4}						
	10:16:20	68×10^{-4}	✓	✓				225°
	26	57×10^{-4}						
	33	75×10^{-4}						
		69×10^{-4}						

[illegible] CABLE

H/ F[illegible]

P.A.

[illegible]

P.A.

Data Sheet Flight 1

4

Date: 2-14-96

Site: A15

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

Range From A3	Time	BER	~~One Channel~~	Two ~~Channel~~	A15 Receiving	D1A Receiving	Heading One	Heading Two
	16:02:15	60×10^{-9}		✓	✓		096	
		66×10^{-9}						
		29×10^{-9}						
		47×10^{-9}						
		57×10^{-9}						
	16:04:30	78×10^{-9}	CH 1					
		109×10^{-4}						
		52×10^{-9}						
	16:06:15	107×10^{-9}					270	
		113×10^{-4}						
		67×10^{-9}						
	16:06:40	67×10^{-4}						
	16:08:04	60×10^{-4}						
		73×10^{-4}						
		30×10^{-9}						
	16:07:23	52×10^{-9}						

Data Sheet Flight 1

(7)

Date: 7-14-96

Site: A15

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

Range From A3	Time	BER	One Channel	Two Channel	A15 Receiving	DIA Receiving	Heading One	Heading Two
	16:22:25	106 X 10^{-4}	✓	✓	✓		045	
	16:22:31	112 X 10^{-4}						
	16:22:38	98 X 10^{-4}						
		65 X 10^{-4}						
	:50	180 X 10^{-4}						
		136 X 10^{-4}						
	23:10	141 X 10^{-4}						
	:15	84 X 10^{-4}						
	:23	78 X 10^{-4}						
		59 X 10^{-4}						
	17:24:01	209 X 10^{-4}						
		132 X 10^{-4}						
		157 X 10^{-4}						
		210 X 10^{-4}						
		256 X 10^{-4}						

Data Sheet Flight 1

9

Date: 2-14-96

Site: A15

Plain Text BER Data
1x10^{-2} (1%) is Passing

Range From A3	Time	BER	One Channel	Two Channel	A15 Receiving	DIA Receiving	Heading One	Heading Two
	10 28:49	75 x 10^{-9}	✓		✓		045	
	58	63 x 10^{-9}						
	29:02	92 x 10^{-9}						
		68 x 10^{-9}						

H.R.

Data Sheet Flight 1

(8)

Date: 2-14-96
Site: A15

Plain Text BER Data
$1x10^{-2}$ (1%) is Passing

Range From A3	Time	BER	One Channel	Two Channel	A15 Receiving	D1A Receiving	Heading One	Heading Two
	16:25:38	64×10^{-9}	✓	✓	✓			225
	48	38×10^{-9}						
	51	53×10^{-9}						
	26:00	67×10^{-4}						
	16:26:09	88×10^{-9}						
	:15	61×10^{-9}						
	:22	63×10^{-9}						
	16:28:59	37×10^{-9}	✓					
	03	57×10^{-4}						
	6	44×10^{-4}						
		20×10^{-9}						
		38×10^{-9}						
	16:27:25	26×10^{-9}						
	16:27:39	43×10^{-9}						
		50×10^{-9}						

37×10^{-9}
68×10^{-4}

H/Pad

Data Sheet Flight 1

Date: 1/24/96
Site: D1A

Plain Text BER Data
1×10^{-2} (1%) is Passing

Range 15 From A2	Time	BER	One Channel	Two Channel	A15 Receiving	D1A Receiving	Heading One	Heading Two	
35	095945	490×10^{-4}	✓			✓	045		PA
35	100000	578×10^{-4}	✓			✓	045		PA
35	100100	311×10^{-5}	✓			✓	045		
35	102841	1155×10^{-5}	✓			✓	225		[illegible]
35	1029[illegible]	1155×10^{-5}	✓			✓	225		[illegible]
35	103100	581×10^{-5}	✓			✓		045	
35	103200	473×10^{-5}	✓			✓		045	
35	103300	992×10^{-5}		✓		✓		045	
35	103400	735×10^{-5}		✓		✓		045	
35	103600	1799×10^{-5}		✓		✓	225		
35	103640	1707×10^{-5}		✓		✓	225		
35	103730	216×10^{-4}		✓		✓	225		
35	104030	500×10^{-5}		✓		✓		045	
35	104130	677×10^{-5}		✓		✓		045	
35	104230	679×10^{-5}		✓		✓		045	
35	104330	981×10^{-5}		✓		✓	225		(Turn)

Data Taken By: ______________ Verified By: ______________